Pit and Quarry

LEADING ARTICLES
In This Issue

American Production and Utilization of Aluminate Hydraulic Cement

by ALBERT SACHS

The regular test applied to 28 day concrete pipe was applied to the aluminate cement pipe, shown in the illustration, after 24 hours.

This pipe at 24 hours showed no crack until the load reached 24,710 pounds while the specifications allowed cracks to appear after 19,200 pounds.

This pipe at 24 hours withstood without failure 38,510 pounds while the 28 day specifications call for a load of 38,400 pounds without failure.

Is Pulverized Coal Practical in Small Plant?—By H. C. Shields.
Are You Paying for Machinery Breakage?—By Dwight Ingram.

For Other Interesting Articles See Table of Contents, Page 47.

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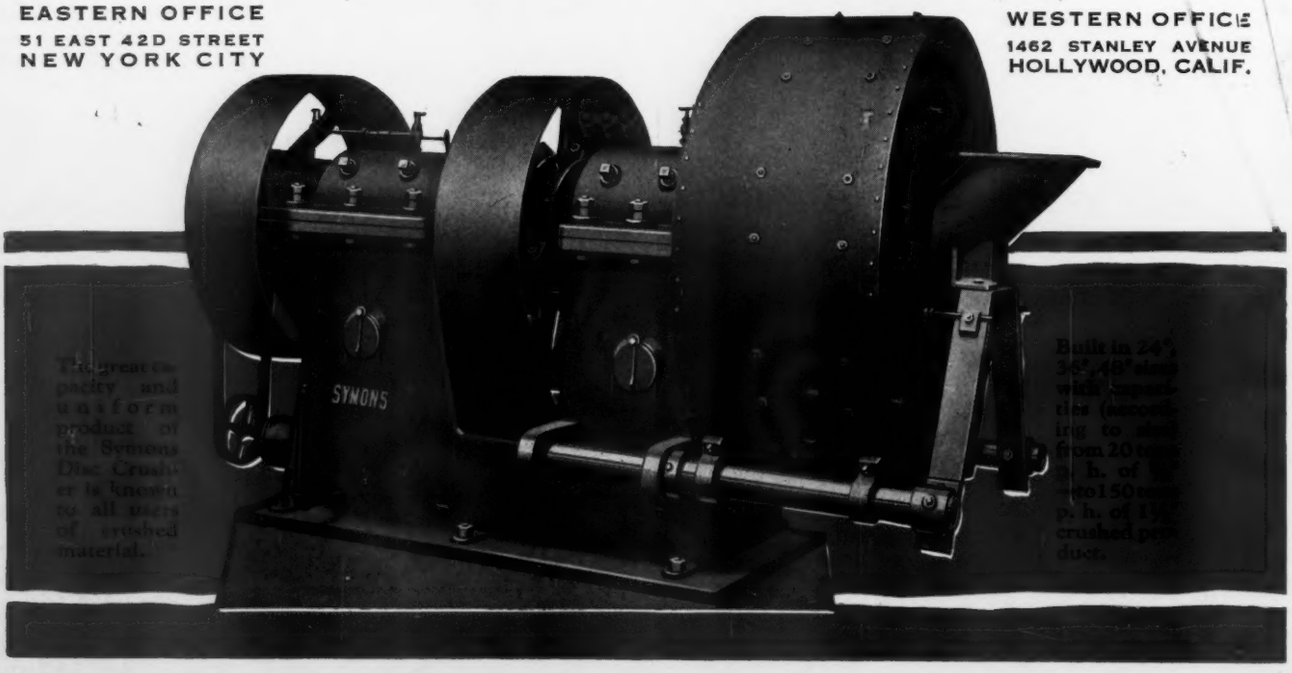

Pit and Quarry

Published Every Other Wednesday for Producers and Manufacturers of Sand Gravel, Stone, Cement, Gypsum, Lime and Other Non-Metallic Minerals.

Subscription price $5 for 3 years; $2 for 1 year. Single copies 25c. Canadian and Foreign Subscriptions $1 extra.

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Next Issue August 4th.

COMPLETE SERVICE PUBLISHING COMPANY
538 S. Clark St., Chicago, Ill.
Publishers of
PIT AND QUARRY and *Pit and Quarry* HANDBOOK

HARRY W. BAUMGARTNER, President
V. E. LARSEN, Vice-President
S. E. COLE, Eastern Representative
90 West Street, New York
Ph. Rector 4154
L. M. WEISS, Southern Representative
805 Gerke Bldg., Cincinnati

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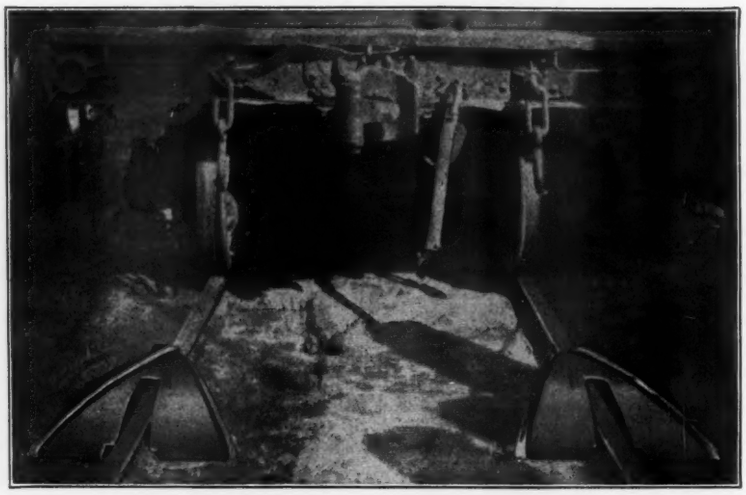

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Pit and Quarry

Vol. 12 CHICAGO, ILL., JULY 21, 1926 No. 8

BUSINESS FAILURES CAN BE AVOIDED

SUCCESS is an attractive word, representing a goal which is sought by everyone. Failure is a depressing idea indicating a sorry plight. It is wise to study certain causes of failure at a time when business is good in order that prosperity may continue. After failure has occurred, it is more difficult to ascertain the underlying principles which caused the disaster. It is best to prepare for trouble before it comes. Anticipating misfortune may mean preventing it. It is not the worrysome attitude of "crossing bridges" that is recommended, but rather a cautious, intelligent survey of the situation with a determination to apply constructive, scientific remedies to any weaknesses that are discernible. In the old days it seemed to be necessary to fail before one could achieve permanent success. "Better to fail before you succeed than to fail after you succeed." True. Better also to attain success through steady processes based on scientific management; to build up an organization that will withstand any ordinary shocks of business variations. A generation ago it was deemed advisable to go through all the so-called diseases of childhood in order to become immune to them in maturity. Modern medical science has refuted this theory just as modern methods of conducting a business have proved that failure is unnecessary and preventable.

There are four stages of business failure—financial embarassment, financial insolvency, total insolvency and confirmed insolvency. Financial embarrassment has been defined legally as a state of being "encumbered with debt, beset with urgent claims and demands and unable to meet pecuniary engagements." The ordinary meaning of the expression, however, does not suggest so serious a condition. It means rather a state of temporary financial weakness indicating unsound foundations of the business for which causes may be sought and to which remedies may be applied. It is an incipient stage of an ailment which, if not cured, will undoubtedly develop into a devastating illness. It corresponds in the business to symptoms in the individual which warn him of approaching trouble. It is like high blood pressure—unless it is detected and checked it may prove fatal. Financial embarrassment is the early stage of an economic disease which must be attended to or it will become uncontrollable. Financial insolvency is more serious. When a concern cannot pay its debts as they mature in the ordinary course of business, it is bordering on disaster. An excess of maturing liabilities over the means of meeting them brings an organization into this state of financial trouble. Total insolvency occurs when there is an excess of total liabilities over total assets. Confirmed insolvency indicates a failure which has involved legal procedure. Bankruptcy, appointment of a receiver and assignment for the benefit of creditors are legal, remedial steps in such a failure.

Every executive should know just where he stands and what possibilities the future holds for his business. He should understand the various causes of failure and determine whether conditions leading to them are existent in his organization. He cannot afford to let the interests of the moment divert his attention from important and vital matters pertaining to the real status of his enterprise. There are possible causes of failure within the organization and outside. The chief causes within are incompetence and fraud; those outside are competition, varying demand for the produce, vicissitude of the business cycle and casualties. Incompetence is probably the most significant of these causes of failure and the one most effectively eradicated. If incompetence is eliminated, most of the other causes are lessened if not entirely abolished. Destruction of a plant by fire would be listed as a casualty, yet might in reality be attributable to incompetence somewhere in the management. Obsolete methods of production are unfailing signs of incompetence. Slow collections are certain proof that the credit department is badly managed. An incompetent sales organization, poor quality of the product, an unprofitable product, shortsightedness in matters of promotion are some of the results of archaic methods of management. A poor financial plan, unwise marketing of securities, poorly-timed sale of securities, and an excessive floating debt are potent factors in a downward course to failure due to incompetence.

One cause of failure outside the organization is competition which has passed the point where it is stimulating and has reached the place where it becomes exhausting. A strong business organization thrives on competition which increases general interest and keeps competitors alert. On the other hand, competition often uses up vital energy that

should be expended in improving the product as well as the methods of financing and marketing. If competition is disastrous, there are only two possible courses open—to combine with the competitors or to liquidate and withdraw from the field. Another cause of failure outside the organization is a change in the demand for the product. There are many failures on record which are due to cessation of demand for the commodity. In some cases the equipment can be utilized in another field as was done by many brewery companies when their machinery was adapted to the manufacture of chemicals and of permitted beverages. It is necessary to watch the trend of business, to know when the peak of demand has been reached, and to recognize any signs which indicate a possible change in the market at some future time. An increased demand may find the producer inadequately equipped to meet the orders; a decreased demand may leave him overstocked.

The operation of the business cycle must be understood in successful operation of business. Causes for the movements in this so-called business cycle are not understood, but results of the reactions are certain. During the period of prosperity profits are large; expansion is universal; prices and the demand for goods increase simultaneously. There follows a reaction accompanied by a lowering of prices and a restriction in demand until a period of depression is reached. It is during this period that failures occur. Only a strong business can withstand the losses which are incurred through the failure of customers and through the inability of the company to keep all of its organization at work. The executive who foresees these possible changes will have made provision for the inevitable periods of reaction and depression. His business will be so well organized that he can come through such a time safely and successfully. Every executive who studies these recurring periods and fortifies his organization to meet them aids in eliminating such disastrous fluctuations. The reactions are due to over expansion, extravagance and various excesses which develop during times of prosperity. The seed of panics seems to be sown during such periods. Every executive who plans for such conditions is a part of a force which helps combat the possibility of frequent recurrence of these trying times. Skill in forecasting the business cycle comes through knowledge rather than luck.

Failures due to casualties are sometimes unavoidable. If they classify under the lawyers' term, "acts of God," they seem to be entirely fortuitous. Most casualties may be provided for, however, through the wide range of policies now offered by insurance companies. Labor saving devices have also diminished the possibilities of hazards in connection with dangerous machinery. Legislation sometimes affects a business so seriously as to be classed as a casualty, but it may be foreseen and provided for in time to ward off failure. Forewarned is forearmed. The alert executive is never caught napping.

A PLAN FOR UNEMPLOYMENT RELIEF

THOROUGH study by experts of the unemployment problem promises to bring definite relief in the near future. Periods of unemployment follow in the wake of periods of prosperity, but could be controlled by means of reliable information regarding the trend of the business cycle. A plan has been suggested by a committee of the American Statistical Association whereby provision will be made to "lessen unemployment by providing facts needed to understand and control fluctuations in the production of goods and obstructions to their sale. These interruptions in economic processes throw men and women out of work."

A practical beginning of this work was made with the Conference on Unemployment in 1921 and with the appointment of Secretary Hoover's Committee on the Business Cycle. Previous to the industrial crisis of 1921 very little data was available from which could be determined the number of the unemployed or fundamental causes of the fluctuations in the production of goods and their sale. It has been stated authoritatively that "the nation's most eminent economists after careful study during the unemployment emergency of 1921 were unable to determine the number of jobless workers more closely than from 3,500,000 to 5,500,000."

That large numbers of workers should be periodically thrown out of employment is an unwholesome condition with far-reaching effects. If a scientific study of these variations in the business cycle can bring about more stable conditions for large numbers of workers, such a study may well receive encouragement and support of our leaders in economic thought and progress.

The report of the committee of the American Statistical Association discusses unemployment as "no vague abstraction of economic theory. To be out of work and out of wages in an economic world in which the dollar earned is the only means of securing food, clothing, and lodging, overwhelms the worker with a sense of personal failure and discouragement, frustrates his hope of maintaining and raising the standard of living of his family and forces his children to begin wage earning too early."

AN EFFICIENT TRAP ROCK OPERATION

By F. A. Westbrook

THE Connecticut Quarries Company has a plant in the Connecticut River Valley at Rocky Hill, Connecticut, which has been in operation for about twenty-five years and which produces about 3,000 tons of crushed stone per week very efficiently, the stone being trap rock.

The equipment in the quarry consists of one Leyner-Ingersoll 70 drifter drill, an Erie steam shovel, two 3-ton Plymouth gasoline locomotives, and dump cars made on the premises.

It may seem strange that only one drill is used in this quarry, there is not even a jack-hammer. The reason is that the Leyner drifter is sufficiently fast for the production. The drilling is done horizontally from the bottom and vertically from the top although not to the full depth of the breast. Dupont 60 per cent gelatin dynamite is used.

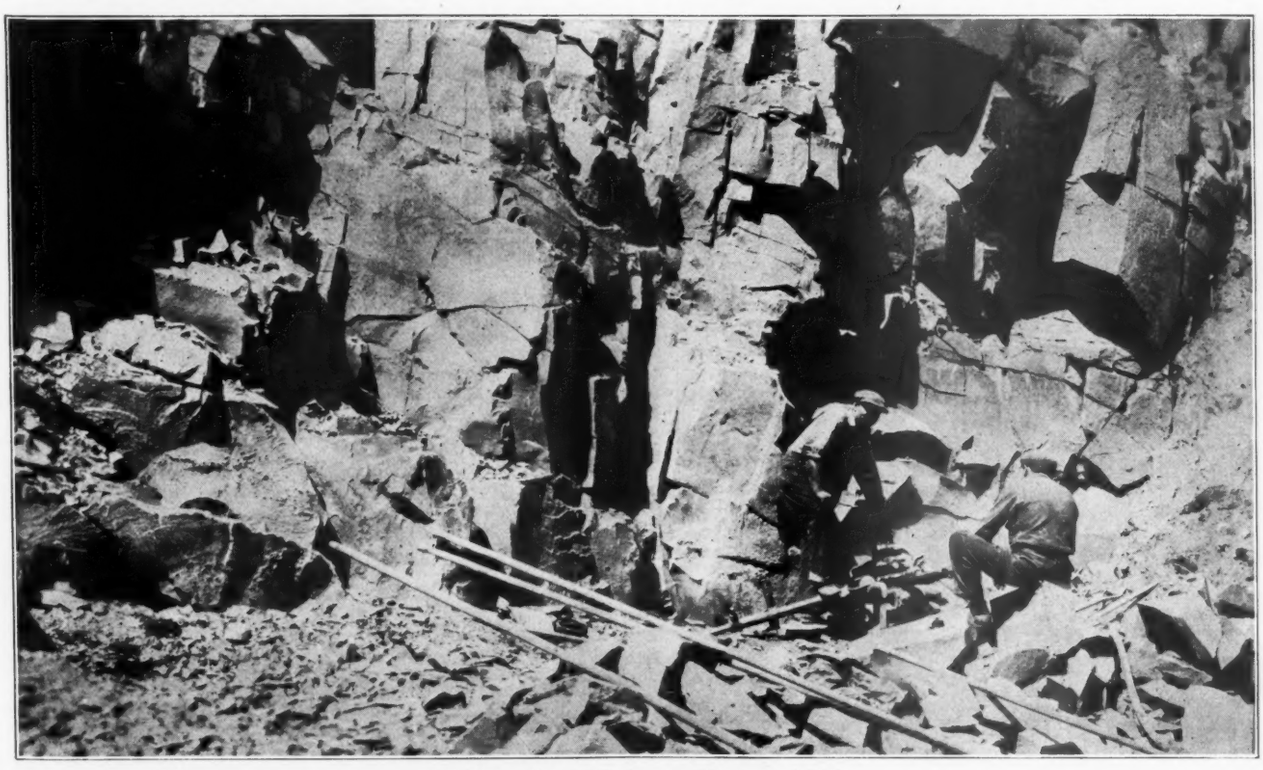
Pieces which are too large for the shovel are broken up with a small charge of dynamite, the Leyner machine with a short drill being used to make the blast. The Erie shovel is provided with a three-quarter yard bucket for loading the quarry cars which are then taken by the Plymouth gasoline locomotives to the primary crusher.

This crusher is located in the quarry and is separated some distance from the rest of the crushing plant. This rather unusual arrangement is the result of changed conditions since the operation was first developed. Formerly when labor was plentiful and cheap the stone was picked over and loaded on the quarry cars by hand, the larger pieces being broken up. Consequently a No. 6 Gates gyratory crusher was large enough to handle the primary crushing and the whole plant was laid out on this basis. During the war, however, when labor became scarce and higher priced, the steam shovel was purchased which meant that large stone was brought to the crusher.

A new primary crusher of the jaw type was also installed which is a 36 inch by 42 inch Buchanan and is located just below the upper bench of the quarry which was then being worked, the lower portions having been exhausted of usable material. The quarry cars are run out on a trestle over the crusher by the Plymouth locomotive and dumped into it, as shown in one of the illustrations.

The crushed stone drops into a hopper for loading a car which runs a distance of about 300 feet by gravity to a No. 6 gyratory crusher in the original plant. When the car has reached the end of the track, it hits a bumper which automatically tips it so that its contents drop into the crusher. It is hauled back to the loading point by means of an electrically operated hoist.

The crushing plant is shown in one of the illustrations. As already stated the stone which is brought in the dump car from the jaw crusher is first carried into a No. 6 Gates gyratory crush-

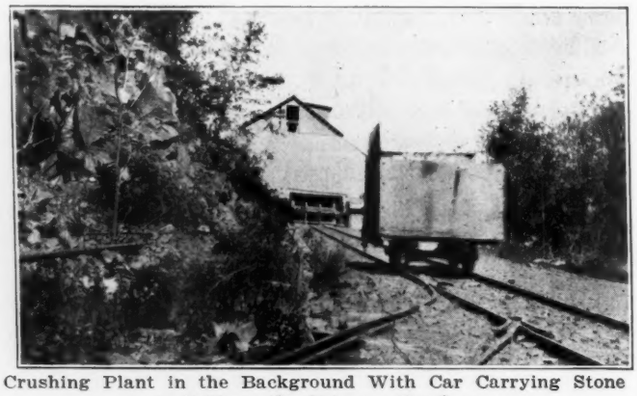


Drifter Drill at Work on a Horizontal Hole

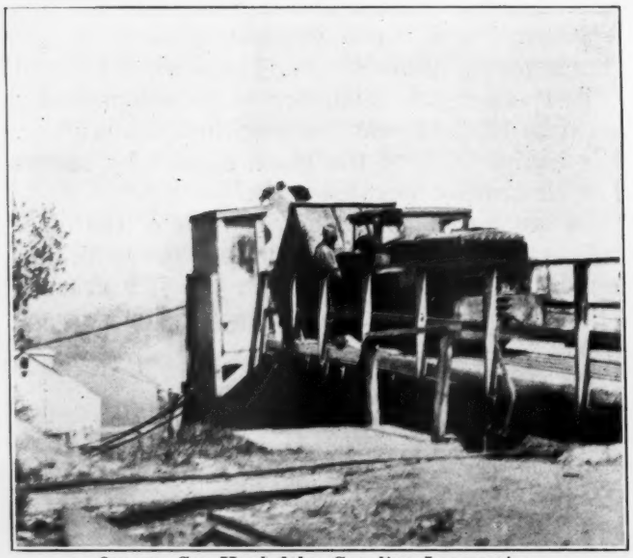
er. It is then picked up by an elevator which consists of a belt with buckets attached made by the Hendricks Manufacturing Company. This elevator discharges the stone into a rotary screen which takes out the 1 inch and 2 inch sizes, and drops them into bins. The ¾ inch, ½ inch and dust pass through the jacket of this screen and into a second screen at right angles to it which sorts them and drops them into bins. The tailings from the first screen go to a belt conveyor which carries them to two No. 3 Gates gyratory crushers. These two crushers are placed one above the other so that the overflow from the first will drop to the second, or it may be helped along by a man with a long iron rod. The stone from these No. 3 crushers drops through a chute to the elevator, and carried back to the screen.

An important detail was necessary at the first

Steam Shovel Loading Quarry Cars Hauled by Gasoline Locomotive

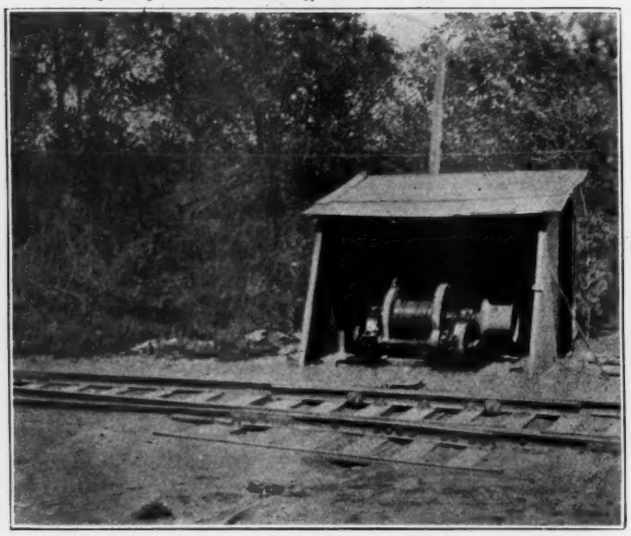


Crushing Plant in the Background With Car Carrying Stone to it From the Primary Crusher



Quarry Car Hauled by Gasoline Locomotive

View of Crushing Plant with Freight Cars Under Storage Bins



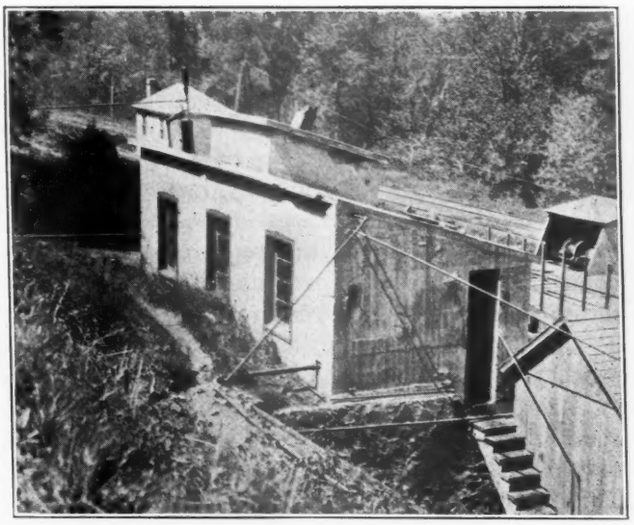
Air Hoisting Engine. Note Sheave Adjacent to Tracks

Office and Freight Car Weighing Scales

screen which is occasioned by the large demand for ¾ inch stone. It frequently happens that the normal production of this size is insufficient for the demand. This detail consists of a housing around the bottom of the first screen. This housing is provided with spouts which can be used to discharge the 1 inch and 2 inch stone onto the belt conveyor which carries the tailings to the No. 3 gyratory crushers instead of permitting them to drop into the bins. In this way the production of the smaller sizes can be increased when desired at the expense of the larger sizes. The belts used for power transmission and conveying are principally Goodyear; the conveying machinery, however, is home made.

This plant is located adjacent to the railroad and has a long spur which divides into two tracks as it passes under the storage bins. Although most of the material is shipped by railroad, a considerable quantity is taken away by trucks belonging to contractors operating in the vicinity of Rocky Hill. The tracks under the storage bins are therefore filled in so that trucks can pass over them, Fairbanks scales being provided for weighing.

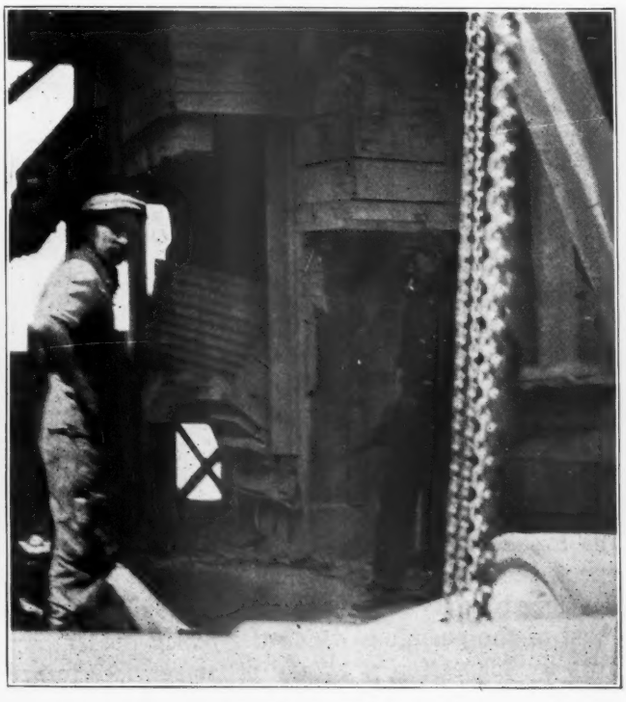
The empty freight cars are taken up to a point beyond the storage bins by the railroad locomotive and left there. The track has a slight grade down almost to the bins under which it is level and then descends again at a very easy grade to the switch. Of course the cars have to be moved while loading under the bins and to facilitate this an Emerson air hoisting engine has been installed adjacent to the track. The cable from the drum of this engine passes through a sleeve and is attached to the freight car. It is located so that it can be used to pull the car to the down grade so that it will coast down toward the main line switch far enough to be out of the way. The location of this engine and a train of several loaded cars, containing part of the day's production are shown in the illustrations. As the cars pass along the track they are stopped on a large Fairbanks track scale for weighing, the measuring beam being located in the superintendent's office situated at this point.



Concrete Compressor House

Compressed air for the Leyner drifter drill, and the Emerson engine is supplied by a Sullivan compressor, 14x8¾x10, driven by a General Electric induction motor. All the motors in the plant are General Electric induction motors.

Primary Crusher with Loading Hopper Below



Secondary Crusher

ARE YOU PAYING FOR MACHINERY BREAKAGE?

By Dwight Ingram

Part I

AN INSURANCE company inspector was recently called to investigate leakage around the bottom of the rear head seam of a boiler. When he looked over the situation he found the through rods at the rear so close together that he had to worm his way in on his side in order to pick at the scale which he saw. This scale was half an inch thick, he found, and very hard. Finally he found the head at the flange had wasted away until only a sixteenth of an inch in thickness remained. This heavy scale had actually supported the head plate, and the discovery and repair prevented any serious damage. But in another case, not long before, internal corrosion was not discovered until it had permitted an explosion of the boiler, killing three employees of the firm and causing a property loss of $25,000.

Boiler Explosions

Incidents like the above are the daily work of the several large and progressive companies which insure boilers and machinery against explosion or breakage. Many producers go along without even steam boiler insurance, because a large proportion of the serious defects in their heating plant give some visible evidence of their existence, and the producer or his engineer believes that he is sure to know when anything starts to go wrong. Such producers and engineers may be shocked to learn that a great many defects in boilers or engines show nothing but the faintest signs of trouble, and these signs are frequently overlooked by the man on the job. For instance, we know of one power boiler where everything looked perfectly sound on the surface and yet the insurance inspector's hammer test showed twenty-two broken staybolts. Often the inspector must work for hours on a tiny clue that the plant engineer considers unimportant, and at the end of his labor finds a weakened condition that could easily make trouble.

Any discussion of machinery insurance begins not with the policies but with the inspection service, because this is without doubt the most spectacular and the most useful angle of the business. The common forms of insurance on machinery embrace the explosion of steam boilers, air compressors or other vessels under pressure, the accidental breakage of engines (especially fly-wheel explosion) and the breakdown of electrical equipment. In one respect the machinery branch is the most highly developed part of the insurance business. For most of the premium which the policy holder pays goes for inspection work and other services to prevent accidents, and a relatively small portion is needed for the payment of losses. A machinery insurance policy is legally a contract for indemnity in case of loss, just like a fire insurance policy, but practically, it is almost a guarantee that if the insured will follow the inspectors' rules there will never be a loss. The modern tendency among the best underwriters is to spend more and more money on accident prevention so that less need be reserved for losses. And the producer would certainly rather pay a fixed charge for service as well as for insurance, because if his potential losses can be prevented from ever happening, his business is saved from costly shutdowns and interruptions. Nobody wants a loss in business, regardless of how much insurance he carries. The fact seems to be well established that uninsured flywheels and boilers do explode not infrequently, but insured ones hardly ever do. Machinery insurance is worth a conscientious investigation, because most producers would certainly be embarrassed in front of their bankers or directors if they should be so unfortunate as to have a loss that was not covered by insurance.

Classes of Machinery Coverage

Of three general classes of machinery insurance —steam boiler, engine breakage and electrical machinery—the most widely known is the first. Boiler explosions have been insured for at least sixty or seventy years, and the older companies in this business have developed a regular science of accident prevention. These explosions have been recognized as possibly the greatest catastrophe hazard of the producing industries. No type of boiler ever designed is non-explosive. Boilers will explode and the amount of damage they do is out of all proportion to their size, and to the pressures usually carried by them. As long as we must depend on the fallability of men and materials some explosions will occur. During each of the past four years we have a known list of over 700 boiler explosions per year, with a total number of about 550 people killed. The reason for this terrible record is simply that few people realize that the energy stored in a boiler is comparable to a large quantity of gunpowder, and most engineers overestimate their own ability to scent possible trouble.

When a producer buys a boiler policy, he buys at least three distinct services in addition to the insurance, namely, inspections, engineering advice and feed water analysis. Of these, the most important by all odds is the inspection. An inspector will visit each insured plant at intervals throughout the year, usually at least three times, one of

which comes just before the beginning of the operating season and constitutes a minute examination and test of every part of the steam plant. This pre-season examination means that the inspector crawls in overalls through the inside of the boiler and all accessible parts of its setting. On at least one of the other visits the inspector comes while the boiler is in operation and makes a study of it and its connections while under pressure. Inspection statistics show that one boiler out of seven is defective. Not only does this service directly detect bad conditions, but also the mere fact that an outside expert is liable to visit the plant at any time is an incentive to your engineer to keep his equipment in good condition. When your men know that you are going to receive an impersonal written report of each inspection, they are prompted to keep the conditions such that the report will reflect credit on them.

The inspectors are often able to call attention to small leaks and other defects that can be corrected by your own engineer, whereas if they are neglected, the corrosion or weakening might make expensive patches or replacements necessary. Inspectors also sometimes can suggest small changes in the setting or in the operation of the boiler, which will reduce the amount of fuel consumed. If this saving amounts to no more than one or two shovelfuls of fuel a day, it will pay for the insurance.

The insurance companies' engineering service extends even beyond the inspection work. The companies maintain technical departments for the purpose of giving free advice on questions of fuel economy and for furnishing plans and specifications for boilers and settings, pressure tanks and special apparatus. Their chemical laboratories are also useful in analyzing samples of feed water which policy holders send in, and usually the cause and remedy can be found for deposits of sediment and scale.

Steam boiler policies are somewhat different in their scope from the insurance that producers are most familiar with. For example, if one of your buildings is destroyed by fire and a city fireman is injured or killed through some negligence of yours which makes you liable for his injuries, your fire insurance policies would only cover your own direct property loss. The fireman's injuries would have to be taken care of by another kind of insurance covering legal liability. However, if a boiler explodes, the insurance policy covers your own loss, also damage to your neighbors' property, and in addition, your liability for death or injury to any persons (the sole exception being employees who are covered by other policies for workmen's compensation or employers' liability).

This coverage, although it is always spoken of as boiler insurance, is not limited to stationary heating or power plants. Locomotive boilers may, of course, but it should be remembered that this covers only explosion and does not include a mechanical breakdown of the locomotive engine. In addition to boilers, practically any vessel or device under pressure can be similarly insured. This extension of the insurance applies especially to air compressors, since careless maintenance and explosions of compressors are not uncommon.

Making Up a Schedule

In making up the rating schedule, special figures have to be worked out for air compressors and locomotive boilers according to the size and condition of each device. In the case of ordinary stationary high-pressure boilers, the basic rate for a three-year policy of $5,000 is $55. This rate is increased if the insured plant is not located near a large city, because the expense of inspections and of repairs is increased when one gets away from the main centers. If a plant has more than one boiler, the additional ones after the first call for a basic rate of only $35 each instead of $55, because the inspection cost is not proportionately increased as more devices are added to the same policy. In the case of producers in the non-metallic industries there will almost always be a rebate allowable at the end of the policy period, because a reduction in rate is granted where the use of the boiler or compressor is suspended for a part of the year.

An important consideration in buying explosion insurance is the size of the policy. The basic policy, which limits the total indemnity for one loss to $5,000, is far too small for most producers. When you are studying this problem you should first estimate the extent of possible damage to your own plant from explosion, including the replacement of the boiler and surrounding buildings or equipment. In the second place you should check up to see if you are near enough to any neighbor to cause damage to his property. Then you should inquire as to whether you would have to cover injuries to your employees or whether these are already cared for by workmen's compensation insurance. And finally you should estimate the chance of any outsider (visitor, inspector, passers-by or neighbors) being hurt by explosion and should add enough indemnity to cover such liability. In most cases the boiler policy should have limits of at least $15,000 or $20,000 in order to cover all of the possible losses, and it should be noted that raising the limit of indemnity does not greatly increase the premium.

When a boiler explodes, the direct destruction of property and the personal injuries are not the only possible losses. The entire production must stop if the power plant is out of operation. In a way your power plant is the main source of your income, for certainly your business is at a standstill

when your boilers are out of commission. If a boiler explosion should hit your plant at the beginning of the producing season or at the height of some special drive for production, the income which you would lose from the ensuing idleness might be more than the direct destruction of property. For this reason the boiler insurance companies have added to the regular insurance another kind of policy, called "use and occupancy" or "business interruption" insurance, which covers the loss of income due to explosion. In any study of insurance on your own plant you should examine both the direct property damage policy and the business interruption coverage, because one can hardly predict which is the more important for your particular plant.

Special Education and Inspection

In addition to the principal functions of paying losses, making inspections and analyzing feed water, boiler insurance companies have some minor services which they offer as special facilities to their policy holders. One of these is a correspondence course for engineers and firemen on fuel economy. Progressive operators realize that the day has passed when fire-room men were picked out for "long back, broad shoulders and red hair," since brute strength alone, while useful, does not necessarily mean cheap fuel. A boiler furnace is a place in which a chemical process is carried on, which can be controlled by simple means so that the process is essentially economical or tremendously wasteful, depending on the intelligent understanding of the fireman. A correspondence course may lead to such improvement in the firing and care of your boiler that it will show a substantial saving in the coal bill.

The second auxiliary service which the insurance companies offer is the inspection of boilers for prospective purchasers. There are many bargains to be had in the country in the way of second-hand boilers which are put on the market by plants which have failed or have outgrown their original equipment. Yet a conservative producer would hesitate to buy such a boiler without knowing a good deal about it. The insurance companies come to the rescue in such a case by offering to send a competent engineer or inspector to examine the boiler and report on both its condition and its suitability for the work of the prospective buyer. We know of one insurance company, at least, which charges only $10 a day plus traveling expenses for this service. And because an insurance company is nation-wide in scope, with branch offices in each locality, such inspections can ordinarily be made in one day and at considerably less expense than if the producer had to send his own man. There is also the feeling that insurance companies maintain a high standard of engineering, and any boiler which passes their inspection is almost certain to be in good order. It may be agreed that there is no form of insurance which returns as much as boiler insurance in the way of valuable engineering service, plus peace of mind resulting from the continuous protection of the inspection work, plus broad policy coverage. The second part of this article will appear in the August 4 number.

U. S. Gypsum Will Manufacture Sabinite Acoustical Plaster

Sabinite Acoustical Plaster, developed at Riverbank Laboratories, Geneva, Illinois, by Dr. Paul E. Sabine, is to be manufactured and marketed by the Gypsum Company under an exclusive license. This material comes to the job already sanded and requires only the addition of water. It is porous in composition and instead of reflecting virtually all the sound that strikes it, as does ordinary plaster, it absorbs a great proportion of the sound, which it transforms by friction into heat-energy. Its covering capacity is greater than ordinary plaster and its application involves no greater problems than the application of ordinary plaster.

While this material was perfected over five years ago, it has been withheld from the market by Riverbank Laboratories until actual job experience should substantiate or disprove the results obtained in laboratory tests. To obtain this job experience two rooms at Riverbank Laboratories, one room of the Geneva, Illinois, high school and auditoriums and radio broadcast rooms at various points in the United States were plastered with it. According to Dr. Sabine these test jobs all are in perfect condition and the material has performed identically on the job as it did in the laboratory.

Tests and researches into the physics of sound according to Dr. Sabine, have demonstrated that through the use of this material a maximum of acoustical efficiency can be obtained in any theater, church, auditorium, school or other room.

Riverbank Laboratories, where Sabinite was developed, is a scientific organization that was founded and is maintained by Colonel George Fabyan. The researches into the physics of sound conducted there by Dr. Sabine are a continuation of the work begun by his late cousin, Professor Wallace C. Sabine of Harvard University.

U. S. to Push Potash Work

Development of the potash fields in Texas is to be pushed with the aid of an appropriation of $100,000 voted by the last congress, according to an announcement made by Secretary Hoover. The work, which will be started this summer, will be under the direction of experts of the bureau of mines and the geological survey.

The purpose of the Government in pushing this work is to combat a monopoly of the potash industry of the world now in control of the Franco-German agency.

LADWIG COMPETES IN CROWDED TERRITORY WITH NEW MODERN PLANT

By E. D. Roberts

WHEN Otto Ladwig started the new sand and gravel plant at Thiensville, Wisconsin, it marked the completion of another step in the plans of Mr. Ladwig and his son to operate an up-to-date sand and gravel plant turning out a high grade product.

In 1915, the Ladwig Sand and Gravel Company was organized, and Mr. Ladwig entered the Milwaukee market with several grades of sand and gravel. His pit was located north of Milwaukee along the banks of the Milwaukee River. These deposits are rewashed glacial deposits and run very largely to fines, or what is commonly called mason's sand. There is plenty of it and the small amount of labor required to obtain it has resulted in a low price. Several illustrations here shown of the methods used in producing this sand will demonstrate the reason for this low price.

One operator strips the two feet of overburden by scrapers and loads the trucks direct from the bank with a loader. A screen over the truck rejects any large stones and rubbish that might be objectionable. Several operators strip the deposit with a caterpillar crane and clam shell bucket, throwing the stripping into the pit previously excavated, this being done while the trucks are elsewhere. When the trucks arrive, the crane loads them direct from the gravel bed. As this deposit is only about 7 miles from the center of Milwaukee, requiring only a short haul, it can be readily seen why this class of material can be sold so cheaply and it can also be seen that many will use this material for concrete work.

Finding that this fine sand, when mixed with chips from the stone quarries, made excellent concrete blocks, Mr. Ladwig organized in 1917 the Ladwig Building Supply Company, with his son in charge of the new company. Operations were first started with a small machine but, as the demand for their block grew, they moved to a large site at Green Bay Avenue and Adams Avenue, where they have installed an up-to-date concrete block plant turning out 3000 blocks per day and where they also maintain the sand and gravel storage for delivery during the winter months.

As their supply of sand diminished, they began to look around for a deposit that would produce a sand satisfactory for concrete work on the jobs where rigid inspection is enforced. They finally purchased a tract of land, 66 acres in extent, in the north city limits of Thiensville, a small town 15 miles north of Milwaukee on the Chicago, Milwaukee and St. Paul Railroad. As the railroad runs along side of the tract and as their block plant and storage yards are located on a spur of the "Milwaukee Road," good transportation service could therefore be expected. This deposit was also located on the same paved road which ran past the cement block plant, making it also possible to ship by auto truck.

The test pits of this land showed from 25 to 30 feet of gravel under the whole area, which is over-

Shovel Loading Material to Hopper at New Plant. Note Field Conveyor Under Construction

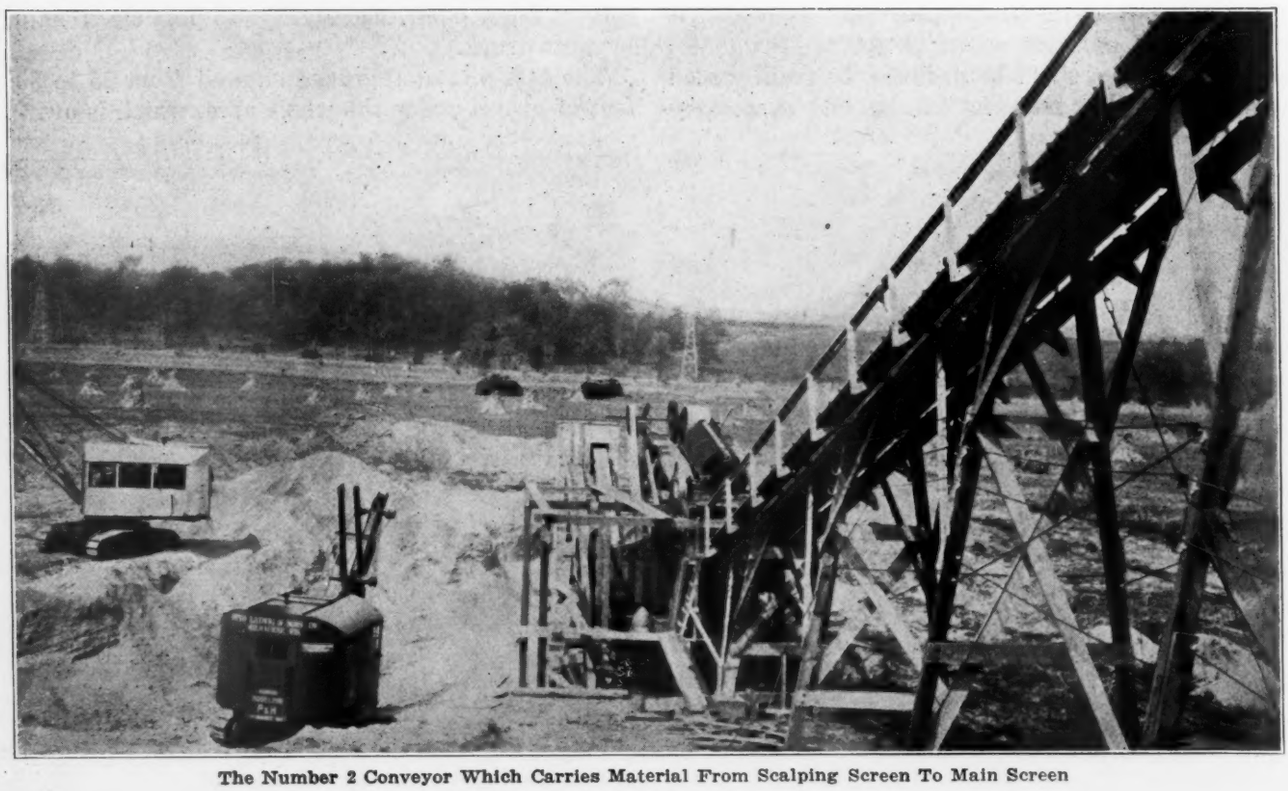
Close-up View of Shovel Discharging to Hopper

laid by about two feet of soil. The gravel grades from coarse sand to small pebbles with an occasional large stone. In fact, it is an ideal deposit for the production of concrete sand, and gravel with a small percentage of crushed stone.

In order to install the kind of plant desired, it was found necessary to incorporate a new company. This was done by merging the Ladwig Sand and Gravel Company with the Ladwig Building Supply Company, and calling it the Otto Ladwig & Son, Inc., Otto Ladwig being in charge of the gravel pit with his son to look after the distribution of the sand and gravel throughout the city of Milwaukee, as well as the operation of the concrete block plant and delivery of the blocks.

The plant site was chosen where it would be convenient to construct a side track 1400 feet in length. This selection required the construction of 1000 feet of road to connect with the highway, and was built and graveled by the company. The railroad company has been a little slow in laying the side track and at present this road is being used by the 18 automobile trucks that are hauling the sand and gravel from the plant to the block plant or to a customer.

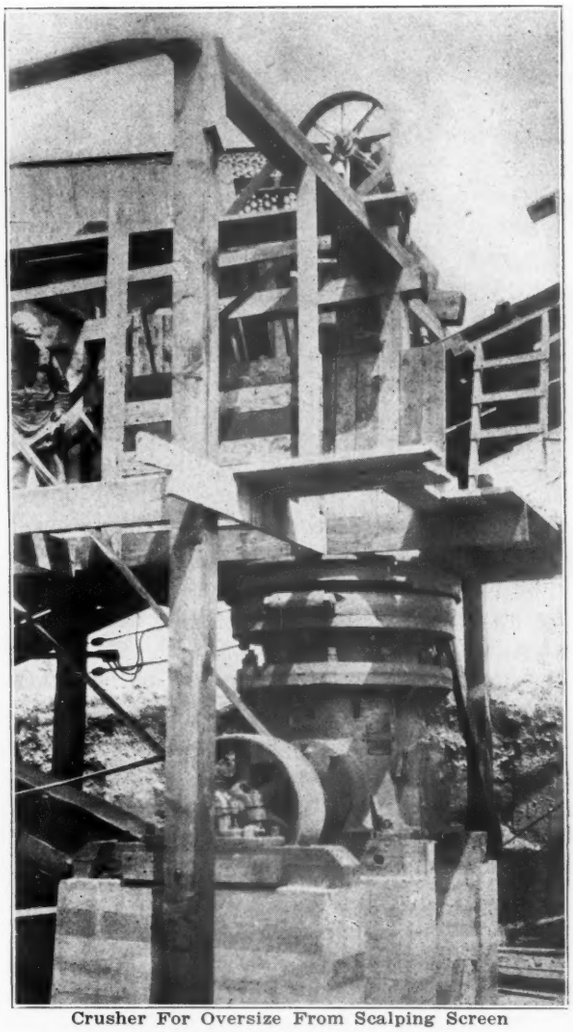
Some filling for the side track was required and was made with the first strippings from the gravel bed. Additional stripping is being done with a Pawling and Harnischfeger No. 206 gasoline caterpillar tractor shovel equipped with a ¾ yard bucket. Trucks dump the stripping in a convenient low spot along the railroad track. Later the stripping will be deposited in the worked over areas.



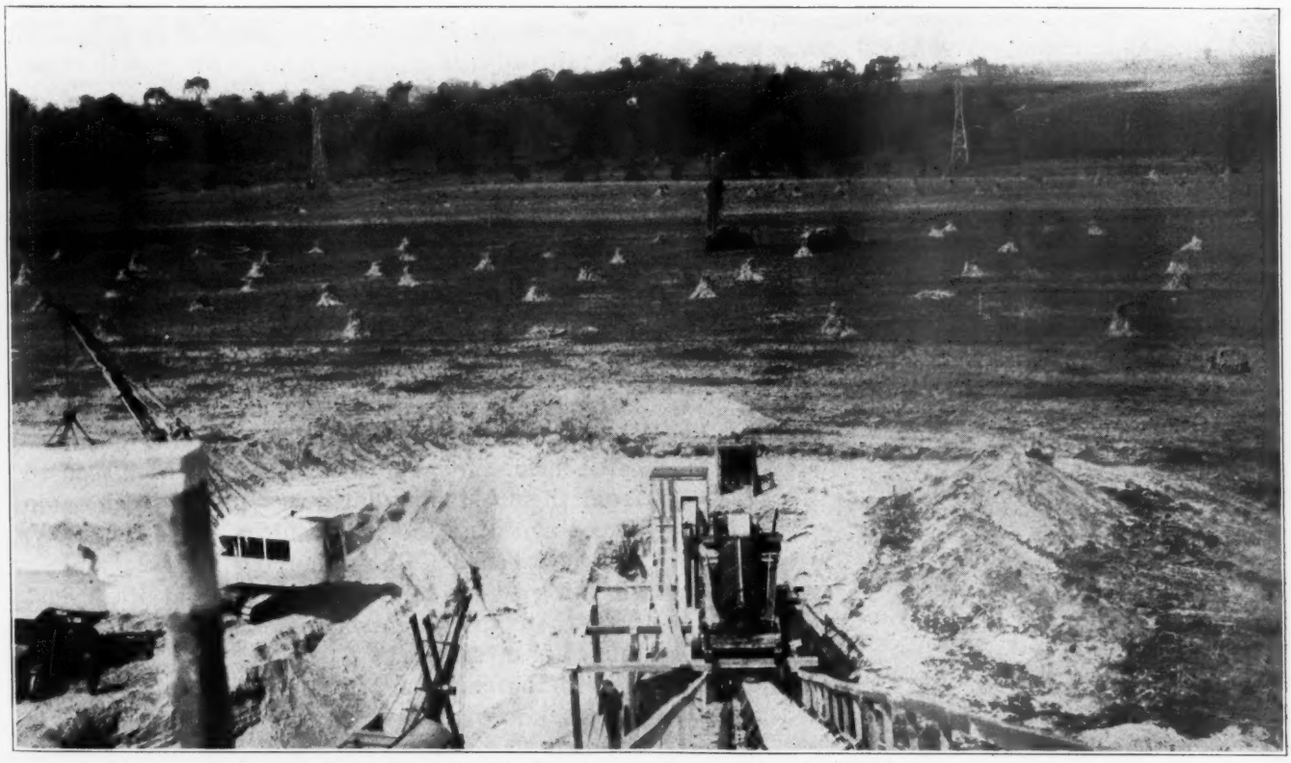
The Number 2 Conveyor Which Carries Material From Scalping Screen To Main Screen

At present, another Pawling and Harnischfeger No. 206 gasoline caterpillar tractor locomotive crane equipped with a ¾ yard clam shell bucket excavates the gravel from the bed and dumps it into a hopper placed over the lower end of the number 1 conveyor belt. This locomotive crane is excavating an area with a radius of 70 feet from the end of the No. 1 belt and in this area they are constructing a field conveyor, one end being supported by a shaft located at the lower end of the No. 1 conveyor. A hopper has been placed on the other end of the field conveyor into which the crane will dump the excavated material, the conveyor rotating about the shaft supported by wheels running on short sections of movable track. After this conveyor has made one turn, a section of permanent conveyor will be put in, extending west in line with the No. 1 conveyor and the rotating conveyor will be moved to the end of the new permanent section. Additional sections of permanent conveyor will be added until the cut has been extended across the tract after which the excavation will be extended laterally by branch conveyors.

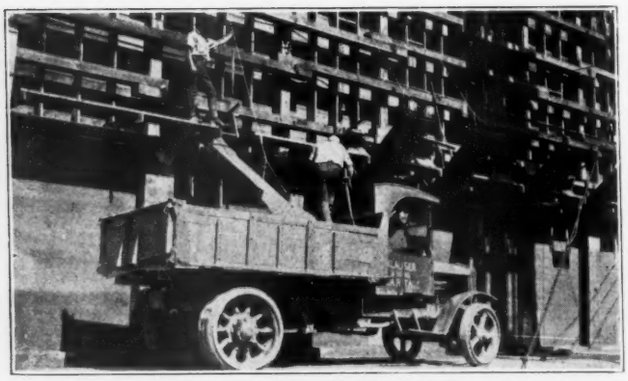
The No. 1 conveyor carries the excavated material up an incline and discharges it into a Toepfer scalping screen which is 9 feet long and 40 inches in diameter. This scalping screen allows all material under 1½ inches to fall through into a chute leading to the No. 2 or main belt. The oversize material drops into another chute leading sideways into a Gates gyratory crusher which crushes to 1½ inches and discharges onto an auxiliary inclined conveyor belt which carries the crushed



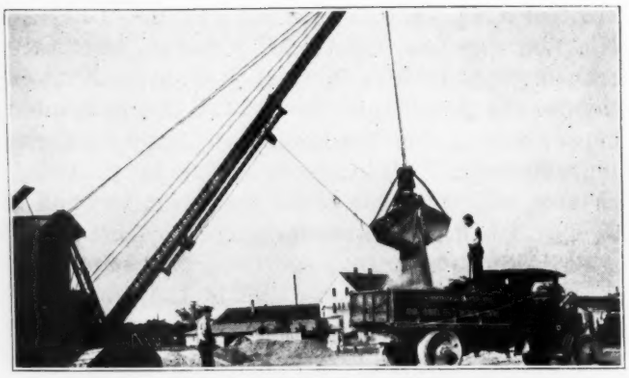
Crusher For Oversize From Scalping Screen



Looking Down From the Bin Showing the Scalping Screen and Number 2 Conveyor



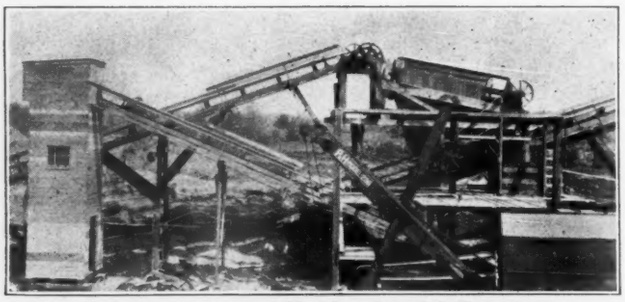
Method of Loading Trucks



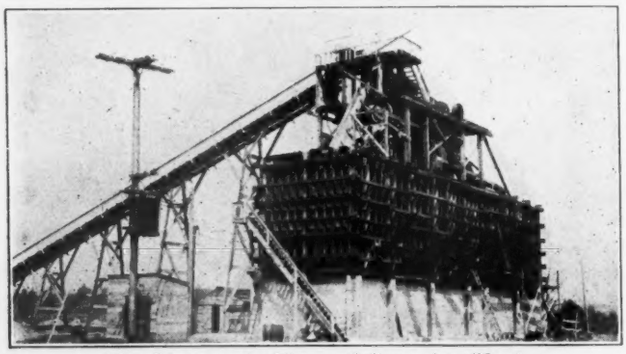
Reclaiming From Stock Piles

stone back alongside the No. 1 belt until it has reached a height sufficient to discharge directly onto it. A 50 h.p. Allis Chalmers motor operates both the scalping screen and the Gates crusher through belt reduction. A 15 h.p. motor placed in a building at the top of the auxiliary belt drives it by an Allis Chalmers gear reduction onto the head pulley.

The No. 2 or main 24 inch conveyor belt carries the material passing through the scalper screen up to the top of the bins and discharges it into the classifying screens. This screen, a large 48x24 foot Lippmann screen, through the center of which has been placed a 6 inch perforated pipe carrying water under pressure, washes the material as well as classifying it. The first section of the screen is solid and serves as a scrubber; the next section is enclosed with an outer sand jacket; and the last section takes out the medium rock, giving three grades of rock, namely: pea gravel, ¾ to 1½ inches and 1½ inches to 2½ inches. Each grade of rock is chuted directly into the proper bin below while the sand and water is led into one of the two Allis Chalmers dewaterers. These are simple in construction being two screw conveyors placed in an inclined box or square trough, forcing the sand out over the upper end of the box or trough while the water overruns the lower end. The sand from the dewaterers is discharged directly into bins below, which have a capacity for 1000 yards of material.



The Scalping Screen and Number 1 and 2 Conveyors



The Conveyor to Bins and Screening Plant

A concrete wall resting on a spread foundation of concrete extends around the outside walls of the bins. These concrete walls have been brought up 10 feet upon which have been placed the upper wooden walls. Partitions were placed inside of the bin walls after which the material was introduced. The material below the spouts acts as a support for that above it and while it cannot be drawn off for use, it avoids the construction of heavy supports for the hundreds of tons which is usually supported by posts.

Sixteen spouts with Lippman undercut gates have been placed in the sides of the bins at the proper elevation to chute the material directly into the railroad cars or into trucks on the opposite side.

Water for washing the sand and gravel is pumped from a creek about 600 feet distant by a 6 inch Allis Chalmers centrifugal pump, electrically operated.

The Boehck Machinery Company of Milwaukee furnished most of the machinery for this plant, and the Lippmann Manufacturing Company of Milwaukee fabricated and furnished the gates and large washing and classifying screen.

The block plant is modern in every respect. All material entering and leaving it must pass over a Howe platform scale with the recording beam located inside the main office. Sand has been secured from their old pit which was mixed with chip screenings from the Wauwautosa Stone Company, who installed a Galland-Henning variable motion vibrating screen to ensure the removal of all dust from the chips which was necessary especially for this class of service.

Both the chips and the sand are dumped from the truck into a hopper from which the material is elevated to a storage bin on top of the concrete

block plant. There are three block machines in the plant, all of Besser manufacture, one is entirely automatic turning out 6 blocks per minute while the other two are hand machines and will turn out 1 and 3 blocks per minute respectively. The larger machine is located directly below the storage bin referred to while the other two machines are served by a skip traveling on an overhead trolley. Besser concrete mixers are located directly over the block machines which they serve, and mix the aggregate with the proper proportions of water and cement and discharge it into the machines. Thirty green blocks are placed on a specially constructed 4 deck truck equipped with springs to ease the jars. These trucks are run on tracks into one of the 6 large steam rooms for steam curing, where they are left on the trucks for from 12 hours in summer to 2 days in winter. After the blocks have been properly cured they are pushed out over the track to the storage yard for further curing and final disposal.

It is not planned to operate the gravel pit during the freezing winter weather experienced in Wisconsin but large stores of sand and gravel will be built up at the block plant during the warmer part of the year to carry over the cold months. At present, an Orton and Steinbrenner caterpillar locomotive crane handles the material into stock piles and loads the trucks from this supply. It is the intention of the company to develop this part of the company's activities next, and in the near future the yard will be thoroughly equipped with all modern conveniences for labor saving and speed in handling materials, unloading cars and loading trucks.

Holmes Heads New Department at University of Missouri

Dr. M. E. Holmes of Columbus, Ohio, was appointed head of the new department of ceramic engineering of the School of Mines and Metallurgy, of the University of Missouri, at the meeting of the board of curators held in St. Louis last week. The new coarse will be opened for registration this coming fall.

Dr. Holmes is a graduate of the University of Indiana and of Cornell University. He has been connected with the ceramic industry for several years. He was for some time chemical director of the National Lime Association and for awhile acting general manager of this organization. During the past three years he has been connected with the Ceramic Experiment Station of the United States Bureau of Mines at Columbus, Ohio, doing research work in connection with the ceramic industry. He is a member of the American Ceramic Society, the Cosmos Club of Washington, The American Institute of Chemical Engineers, The American Chemical Society, and Sigma Xi fraternity.

The new course in ceramic engineering was established by the School of Mines and Metallurgy at the request of the clay industries of Missouri. The ceramic industry in Missouri now ranks next to lead in point of value in the mineral industry of the state, and is growing rapidly. Missouri ranks third among the states as a producer of clay products. The clay people have for several years felt that they were entitled to technical aid within the state for this important industry.

As a means of interesting students in the new ceramic course the Clay Association has voted three scholarships of $100 each to be awarded to students enrolling in the ceramic course next fall.

Prominent Explosive Figure Passes

Frederick C. Peters, Manager of the du Pont Company's New York office, one of the outstanding figures in the sales branch of the explosives industry, died June 30th in the Fifth Avenue Hospital, New York, after an illness dating from early in May. Mr. Peters' health had suffered a general breakdown and death was due to a complication of troubles rather than to any definite illness.

He was educated in the public schools of New York and had passed examinations for entrance to New York University when he decided to go to work. He entered the New York office of the Repauno Chemical Company, which later became a part of the du Pont Company, as office boy on May 1, 1891—thirty-five years ago—and continued his connection with that office during all of his business career. He became shipping clerk, bookkeeper, cashier, salesman and executive, in turn, being manager of the office in 1903 when the work was taken over by the du Pont Company.

He was appointed manager of the combined organization and had charge of sales work in the New York district, which was the largest in the country. He combined with this work many of the company's export interests and soon became an important personage in the industry both here and abroad. It is an interesting fact that his death occurred at the end of the banner business month in the history of the New York office.

The Appraisal Engineer

Finally, some property owners do not insure all parts of their plant. It is almost universal, for instance, to exclude from the policies the cost of foundations and excavations of buildings, because these are very little subject to damage by either fire or tornado. Foundations of machines, fireproof vaults and other parts of a property that are especially free from susceptibility to damage are often left out according to local conditions and the advice of the insurance expert who draws up the policy form. If such property can be omitted from the policies, it is an advantage to do so.

ENDLESS COMBINATION POSSIBLE WITH COLORADO MARBLE

COLORADO marbles are very hard and brittle and consequently have been more or less shattered by the upheavals which lifted them into mountains, and left the many vari-colored layers standing on edge like the leaves of a book. Sometimes large blocks which seemed flawless when quarried, developed cracks when polished. Some ledges are too much shattered to produce any blocks of marketable size fit for cut and polished work. These however, are no longer a loss, but a source of profit under the new order of things. They are now crushed and used to manufacture slabs which rival, if they do not excel in beauty, the rock in its original form, and have many advantages over it. One great advantage is the use of broken rock which could not be used in any other way, thus turning the waste into profit. Another is, that the material can be made to order. A builder can have his wainscoting and other trimmings made of a texture and shade to suit the other materials of the building. Table-tops can be made of a shade that will harmonize with the paint or paper.

The immense ledges of marble which The Colorado Decorative Marble Company is exploiting, in the Sangre De Christo range of mountains about 25 miles south of Salida, Colorado, all stand on edge across a deep canon, so that it is possible to open a quarry at the foot of each different colored ledge, adjacent to the wagon road which follows the bottom of the canon. It is about half a mile across the ledges, and material from any part can easily be run to either of the two mills on the property, as the road extends the entire distance.

Along this road are the boarding houses, dormitories, shops and other buildings of the company. The canon, and mountain slopes above, are heavily timbered, and a cold mountain stream furnishes necessary water, so these requisites are right at hand. The pine, spruce and aspen make good fuel and are being used to operate the air-compressor, which in turn furnishes power for the derricks and drills.

The cliffs of marble rise more than a thousand feet high on both sides and are for the most part bare of any over-burden. It is an ideal quarrying proposition, and the supply is unlimited. The marble is of many colors and textures. The most noticeable colors are white, gray, pink, yellow, blue, brown and black. In some ledges several colors are mixed in mottled figures. In crushing, it fractures in sharp angled fragments, which adds to its beauty when pressed into slabs and polished.

The great variety of colors and shades can be made up into almost endless combinations, and the use of large or small fragments can be made to add to the variety of the product, so that it should be possible to suit any taste.

This company has, so far, been mainly developing the colors and qualities of their various ledges, and experimenting with the different methods of crushing and screening. However, they have shipped considerable of their product to market during the past year.

In their operations, the large blocks are quarried and shipped to the monument dealers and the spalls and such rock as will not fill the bill for monumental or other cut work, which is ordinarily waste material, is crushed, screened and sacked and shipped to their works in Denver. The different sizes and different colors are sacked separately and marked with a number which indicates its qualities. Even the dust is used in the process. It is only five miles down grade to the railroad at the mouth of the canon.

With this unlimited supply of material so easily worked and handy to the railroad, and its adaptability to so many uses, the decorative marble business seems destined to undergo some material changes.

Colorado has many large bodies of exceptionally fine marble, in colors ranging from a snow white, to a moss green. Being harder than the marbles of the east, it takes a finer polish and holds it longer. For this reason it has been selected for some of the finest buildings in the eastern cities despite the cost of the long haul. The Lincoln Memorial in Washington, D. C., is constructed partly of Colorado marble.

It is but fair to state that some, at least, of the Colorado marbles are not pure carbonate of lime (calcium carbonate), but contain other elements which give them their superior hardness and quality.

Arsenic in Canada

Sales of white arsenic by Canadian producers during 1925 amounted to 1,003 short tons, not including export shipments of concentrates and residues containing 713 short tons of white arsenic. Large stocks were built up in anticipation of a heavy demand in 1925, but the boll weevil, the enemy of the southern cotton crop, was not so active, with the result that Canadian producers' large stocks remained unsold at the close of the year. The greater part of the Canadian production of arsenic is obtained from the south Ontario smelters as a by-product of the ores from the cobalt district, and a small amount is contained in residues exported from these smelters. British Columbia's annual production of arsenic is contained in concentrates shipped from the Nickel Plate Gold Mine to the Tacoma Smelter for further treatment. No production of arsenic from the arsenical gold ores of Nova Scotia was reported for 1925.

AMERICAN PRODUCTION AND UTILIZATION OF ALUMINATE HYDRAULIC CEMENTS

By Albert P. Sachs, Technical Director, Universal Trade Press Syndicate

THERE have been published in "Pit and Quarry" recently translations of reports chiefly on German work in connection with the development of high aluminate cements. Although the first commercial production of these cements and their industrial utilization took place in France much work was independently done in this country and the commercial use has reached such a considerable magnitude that a description of the American practise is deemed desirable.

By way of introduction some general remarks will be made about cements. Setting and hardening of cements are totally distinct properties. Setting refers to the loss of power to be molded or shaped, and is the well known stiffening of the mixture of cement, aggregate and water; hardening is a subsequent phenomenon representing the acquisition of strength. Slow setting is desirable to permit the work to be done properly, to fill forms, etc. After the setting quick hardening is desirable as the sooner hardening has reached a specified point the more quickly can the structure be placed in service. Aluminate cements as compared to portland cements are slow-setting and quick hardening, that is, they possess the two desirable although distinct properties. The great value of aluminate cements is their quick hardening. Although they are stronger than portland cement it is not so much the increase in strength (although this is valuable) as the increase in speed of hardening (while retaining slowness of setting) which gives aluminate cement its great value.

Aluminate cements are not clinkered like portland cement but are fused to a liquid or pasty mass, so that the French call aluminate cement "ciment fondu" or fused cement.

Although the commercial use of aluminate cement is new it is by no means altogether new. Vicat as early as 1818 stated that undecomposable cements (undecomposable by saline waters) would be obtained if the ratio $\left[\frac{SiO_2 + Al_2O_3}{CaO + MgO}\right]$ exceeded 1. The ratio in portland cement is 0.5. To increase this ratio the silica cannot be increased as this produces materials of the type of metallurgical slags without setting power. By increasing the alumina (with simultaneous decrease of SiO_2 and CaO) the aluminate cements are obtained. Bied, who obtained the French patents on aluminate cements, was attempting to produce a cement more resistant than portland cement to sulfate solutions so common in French ground waters and bore in mind Vicat's criterion.

At the same time Spackman and Lazell in the United States working independently of Bied and with other purposes in mind took out patents covering our modern aluminate cements although there is other earlier work on record. Spackman wanted to make an accelerator for lime and natural cement and marketed his accelerator as "Alca"

Figure 1

(alumina-calcium oxide) and described it as early as 1910.

In 1916 the Bureau of Standards worked on high alumina cements and because of their rapid hardening and great strength values suggested their use for gun emplacements during the War. After the War it was announced that the French working independently had actually used aluminate cements for this purpose and had kept the matter secret for military purposes. At the 1919 meeting of the American Society for Testing Materials, F. H. Bates of the Bureau of Standards read a paper on aluminate cements; at the same time Endell read a paper on "High Alumina Cements" before the Association of German Portland Cement Manufacturers. At about this time the first commercial high alumina cement was manufactured by Bied in France. Thus we have a picture of the progress made by the scientists of the various countries. At present aluminate cement is manufactured in the United States by The Atlas Lumnite Cement Company under the American patents as sole producer; their product is called "Lumnite" Cement (the name refers to the bauxite which is the source of the alumina).

The following formulae show the difference between portland cement and aluminate cement:

Portland Cement		Aluminate Cement	
SiO_2	22.0%	SiO_2	5.0%
Al_2O_3	6.5%	Al_2O_3	42.0%
Fe_2O_3	3.0%	Fe_2O_3	10.0%
CaO	63.0%	CaO	42.0%
MgO	3.0%		
SO_3	1.5%		
Impurities	1.0%	Impurities	1.0%

We thus have a picture in mind of the work leading to the production of the new cements, how they differ in composition from portland cement as shown in the table, and how they possess the advantages of slow setting and quick hardening. The following table shows the physical properties of some aluminate and portland cements and is taken from a recent paper by Bates of the United States Bureau of Standards.

	Aluminate Cements				Portland Cements			
	A	B	C	D	E	F	G	H
Tensile Strength 1:3 Standard Sand Mortars, Lbs., per Sq. In.								
24 hours	372	330	415	330	125	204	122	173
72 hours	425	310	...	...	200	320	242	255
7 days	435	330	280	690	255	415	323	327
28 days	425	310	335	540	330	460	383	375
Compressive Strength 1:3 Standard Sand Mortar, Lbs. per Sq. In.								
24 hours	5615	5345	4410	2860	745	1900	475	400
72 hours	5120	5995	....	....	1435	3210	1315	1335
7 days	5085	5640	4880	8610	2140	4195	1635	2205
28 days	4835	6050	5285	7845	3150	5380	2650	3475
Compressive Strength 1:2:4 Gravel Concrete, Lbs. per Sq. In.								
24 hours	2880	2160	3145	2930	....	215	....	....
72 hours	3330	3245	....	....	460	825	....	....
8 days	3260	3190	3570	6010	875	1905	1310	1655
28 days	2845	3480	3370	7060	1615	3030	2410	2640

A is a commercial aluminate cement, the other three being experimental batches from the Bureau of Standards. The portland cements are domestic products except F which is an imported super-portland cement. Super-portland cements represent the German attempt to produce quick-hardening portland cements as Germany's poverty in bauxite ores makes it impossible for her to produce aluminate cements. These super-portland cements differ but little from ordinary portland-cements except in the care with which they are produced. The superior properties are a tribute to this care.

The following compression tests were made by E. L. Conwell & Company of Philadelphia on 6"x12" concrete cylinders of Lumnite cement and the aggregate indicated, each value being the average of 3 tests:

	1 Lumnite Cement, 2 Sand, 4 Pebbles	1 Lumnite Cement, 3 Sand, 6 Pebbles
1 day	3441 lbs. per sq. in.	2071 lbs. per sq. in.
2 days	3818 lbs. per sq. in.	2441 lbs. per sq. in.
3 days	4127 lbs. per sq. in.	2598 lbs. per sq. in.
7 days	4391 lbs. per sq. in.	2663 lbs. per sq. in.
28 days	4462 lbs. per sq. in.	2691 lbs. per sq. in.
3 mos.	4813 lbs. per sq. in.	2748 lbs. per sq. in.
6 mos.	4846 lbs. per sq. in.	2962 lbs. per sq. in.
9 mos.	5009 lbs. per sq. in.	3317 lbs. per sq. in.
1 year	5072 lbs. per sq. in.	3460 lbs. per sq. in.

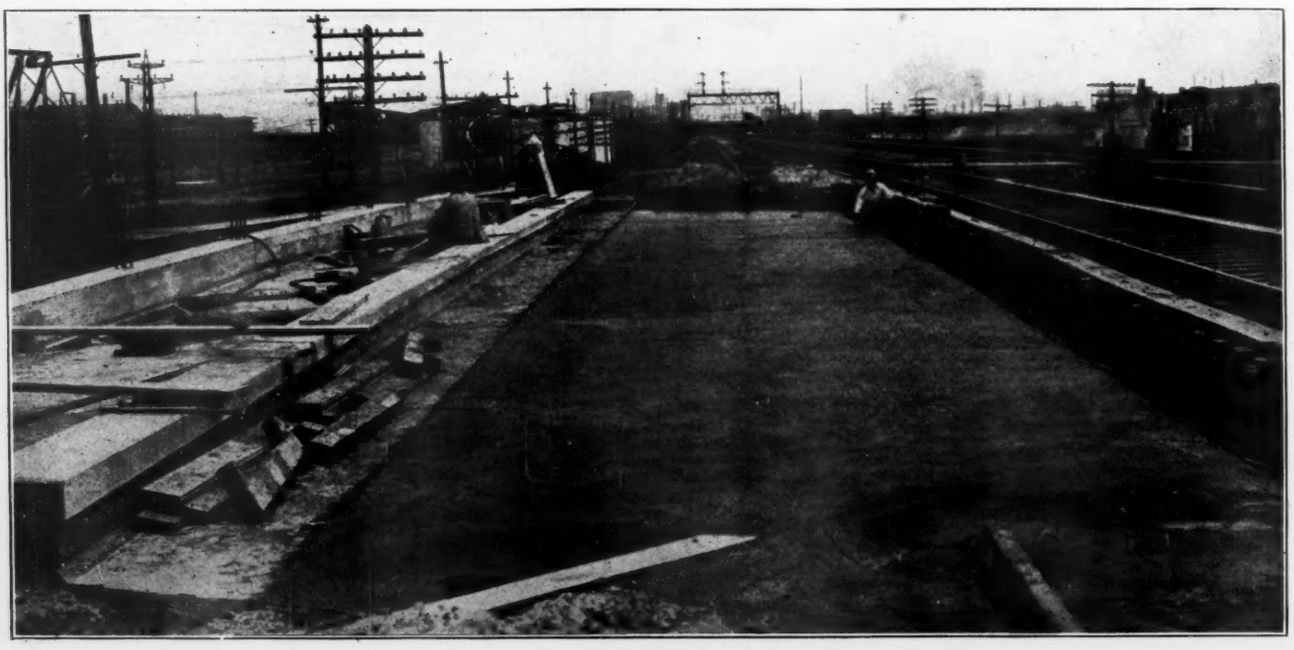


Figure 2

Tensile strength tests below were made by R. W. Hunt Company on 1:3 Ottawa and mortar briquets.

TENSILE STRENGTH

1 day	464 lbs. per sq. in. (average)
2 days	487 lbs. per sq. in. (average)
3 days	518 lbs. per sq. in. (average)
7 days	537 lbs. per sq. in. (average)
28 days	561 lbs. per sq. in. (average)
3 mos.	591 lbs. per sq. in. (average)
1 year	628 lbs. per sq. in. (average)

Compressive strength tests below were made on 1:3 Ottawa sand mortar 2″x4″ cylinders.

COMPRESSIVE STRENGTH

1 day	4725 lbs. per sq. in. (average)
2 days	4905 lbs. per sq. in. (average)
3 days	4040 lbs. per sq. in. (average)
7 days	4985 lbs. per sq. in. (average)
28 days	5004 lbs. per sq. in. (average)
3 mos.	5289 lbs. per sq. in. (average)
1 year	5724 lbs. per sq. in. (average)

The tables show clearly why the manufacturers of aluminate cement have been able to adopt as their slogan "28 day concrete in 24 hours." Aluminate cement given to mortar and concrete strengths in 24 hours in excess of those obtained with portland cement in 28 days. For comparison it may be noted that the Standard Specifications for Portland Cement of the American Society for Testing Materials (C9-21) call for tensile strengths of 200 lbs. per square inch at 7 days and 300 lbs. per square inch at 28 days. The Tentative Specifications and Tests for Compressive Strength of Portland Cement Mortars (C9-16T) of the A. S. T. M. requires compressive strengths of only 1200 lbs. per square inch at 7 days and 2000 lbs. per square inch at 28 days. The increase in strength of aluminate cement mortar and concrete after 24 hours may be small or negligible, while portland cement products increase in strength during the entire 28 day test period to a value which remains less than the 24 hour value for aluminate cement. The durability of aluminate cement is not yet fully known as it has not been in use sufficiently long but there is no reason to believe that its life will prove to be less than that of portland cement.

Aluminate cements are said to be more resistant to salt solutions than is portland cement. This is undoubtedly probable in many cases, but the results are apt to mislead somewhat. Disintegration of cement mortar is largely controlled by the voids present or to the porosity of the product. A porous aluminate cement product may disintegrate easily because of mechanical effects due to crystallization and expansion of salts, while a dense nonporous portland cement may prove resistant. The evidence so far accumulated tends to show that aluminate cement is more resistant to the chemical corrosive action of many salt solutions than is portland cement.

Even so remarkable and valuable a product as aluminate cement may have its disadvantages. One disadvantage—if it be a disadvantage—is that closer control of the amount of water in the mix is necessary than for portland cement. While portland cement will stand a certain excess of water over the optimum value without too great loss in strength, aluminate cements are very seriously affected by any excess of water above the optimum value. If a working mix is not obtained for a given aggregate additional water must not be added but a different aggregate or mixture of aggregates must be used. This involves extra care and the extra care in itself helps to produce better results.

The applications of aluminate cement are numerous. They depend on several factors:

1. Aluminate cement hardens so much more quickly than portland cement that days or weeks may be saved in finishing a project. This is obviously important in road and bridge repair work as it cuts down interruption to traffic. Numerous other applications where savings in time are important will be considered.

2. Aluminate cement concrete and mortar are stronger than the portland cement products. This added strength may be useful.

3. Aluminate cement products resist corrosive waters better, making them desirable in certain projects.

4. Aluminate cement can be used in colder weather than other building cements because of

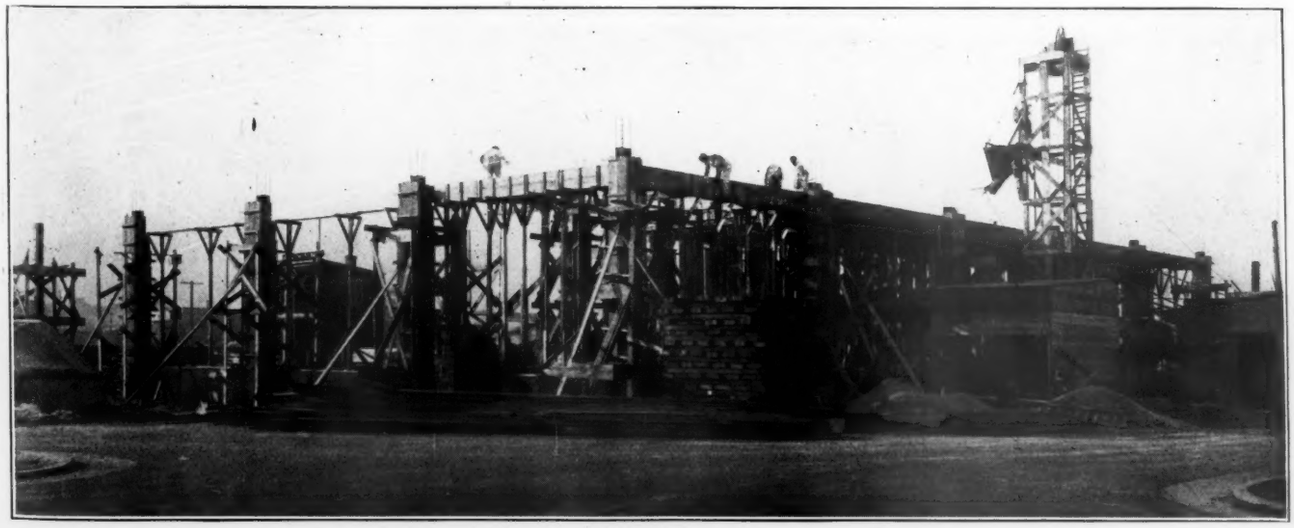


Figure 3

the greater heat of chemical combination of the water and binding constituents; this is an accompaniment and a result of the rapid hardening.

As against all these advantages, aluminate cement costs more (because of the greater cost of the raw material bauxite, etc.) and requires more care in the field. Frequently the cost is not greater than for portland cement as the greater strength of aluminate cement permits smaller members and the rapid setting and hardening involves the use of fewer forms for a given project. The saving in time is in many cases valuable.

The following examples are chosen entirely from American practise involving the use of Lumnite Cement (photographs by courtesy of the Atlas Lumnite Cement Company).

Figure 1 shows a section on Indiana State Highway No. 34 at Bluffton, Ind. near Wolf Lake, Ind., October 3, 1925. The previous day the 15 foot section on which the 20-ton mixer is seen working was poured; it hardened in 24 hours and was ready for traffic while the other 15 foot widths was being poured. After 24 additional hours (total 2 days) the completed 30 foot section (163 feet long) was thrown open to automobile traffic.

Figure 2 is a photograph of one section of the concrete floor slab of the subway carrying the Santa Fe and Illinois Central Railroad tracks over California Avenue just north of 35th Street, Chicago. The slab is one of four which are approximately 95 feet in length and 16 feet wide, with a thickness of 4½ inches. The first slab (shown in figure) was placed Tuesday, July 21, 1925, and traffic placed on it Saturday, July 25, 1925.

Results similar to those indicated in figures 1 and 2 can be obtained also in building construction. Figure 3 shows the Times Building at Atlantic City, N. J. on February 19, 1926. Piles, floor slabs, beams and columns were built of aluminate cement concrete (1:2:4: mixture); forms were removed in 24 hours. The building was completed March 19, 1926. This was 30 days earlier than possible by ordinary methods.

Figure 4 shows foundations for heavy generators and motors built with aluminate cement concrete by the Donner Steel Company at Buffalo, N. Y., July 14, 1925, and the load put on the concrete within 24 hours.

The illustration on the front cover of this issue shows an interesting test. The Newark Concrete Pipe Company of Newark, N. J. made some 54 inches aluminate cement concrete pipe for the Cuyahoga County Drainage System of Cleveland, Ohio. The test ordinarily applied to 28 day concrete pipe was applied to this pipe after 24 hours (May 2, 1924) by the County Sanitary Engineer. Specifications require that no crack appear under a load of less than 19,200 lbs.

The aluminate cement pipe at 24 hours showed no crack until the load reached 24,710 lbs. The total load applied at 24 hours without failure of the pipe was 38,510 lbs.; the 28 day specifications call for a load of 38,400 lbs. without failure.

A 54 inch section of such pipe less than 24 hours old weighing two tons was lifted with a crane and

Figure 4

dropped from a height of 5 feet. Five such drops produced no sign of cracking.

Figure 6 shows precast aluminate cement concrete cylinders weighing 50 tons each, of which 240 were built for the U. S. Navy Pier at Puget Sound Navy Yard, Bremerton, Washington. The shafts were 4 feet 6 inches outside diameter and the bell 15 feet 3 inches in diameter. The overall length was about 60 feet, the skirt on the bell and the length of shaft varying in accordance with the location of the cylinder in the pier structure. The thickness of the cylinder shell was 6 inches. The shells were picked up by crane 24 hours after casting and set into the water so that the bell covered a pile cluster. The water was forced out by air, the inside was cleaned and filled with portland cement concrete. The shells alone consisted of aluminate cement concrete. These shells were the first ever cast and handled from the start as one piece of reinforced concrete. In this case the quick hardening cement in spite of considerably higher direct raw material costs on the 9,000 barrels of aluminate cement used, actually caused a saving due to the following reasons. The shells were cast as needed and used immediately thus obviating storage space. The shells were cast in one piece and remained in vertical position saving in plant equipment, labor and hazard in launching. Portland cement shells for another part of the same job had to be made in heavy sections and required considerable reinforcing steel because of the rough usage in joining, storing and launching. The illustration shows five complete aluminate cement shells ready to remove from the casting pier. These operations were carried on during 1925.

The value of aluminate cement in freezing weather is illustrated by the following. Two safety islands were poured December 9, 1924, in Keosauqua Street, Des Moines, Iowa. They were 20 feet long, 3 feet wide and 6 inches deep. Aluminate cement was used. December 9, 1924, was very cold and during the night the temperature dropped to 5°F. (27°F. below freezing). A test tube containing light lubricating oil and a thermometer was inserted in the concrete and a temperature record kept. At no time did the temperature in the concrete drop below 38°F. (6°F. above freezing). The concrete was covered only with tar paper and 6 inches of straw. When the temperature of the air was at its lowest (5°F. or 27°F. below freezing) the concrete happened to be nearly at its maximum (48°F. or 16°F. above freezing).

This description of the properties and uses of aluminate cement serves only as an outline of the story of a material which represents the greatest advance in hydraulic cements in the century since portland cement was first produced.

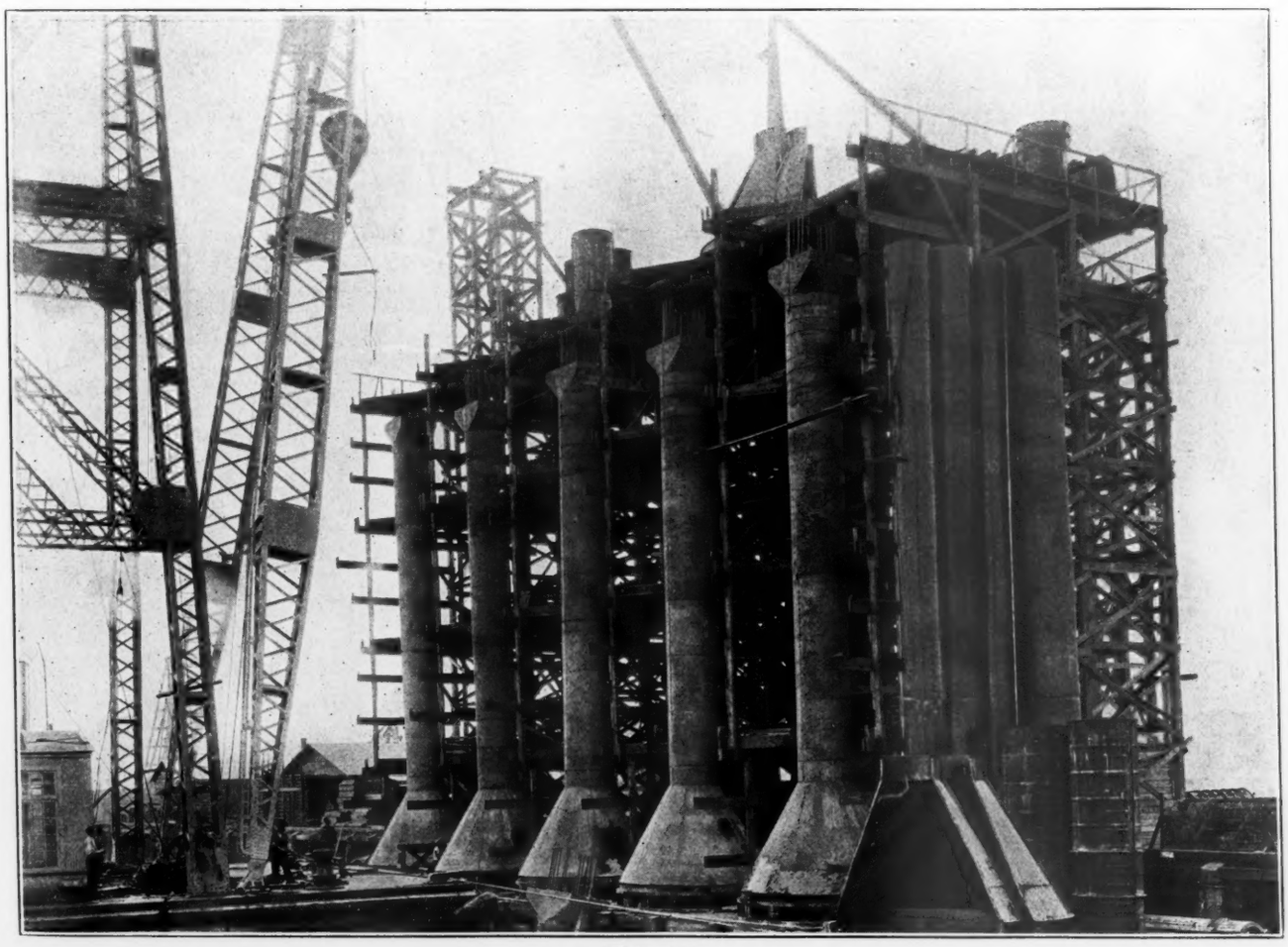


Figure 6

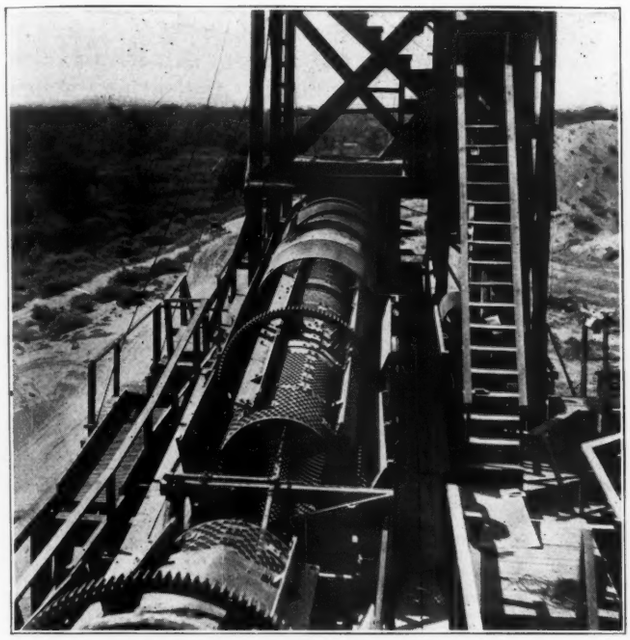
NEW CALIFORNIA SAND AND GRAVEL PLANT PRODUCING 1000 TONS PER DAY ECONOMICALLY

By H. W. Munday

CALIFORNIA has recently added to its long list of modern plants the new sand and gravel plant of the Bakersfield Rock and Gravel Company at Bakersfield. The material in this new pit consists of various kinds of rocks, including diorite, trap rocks, quartz and a small percentage of more or less altered granite. Now and again a gangue from vein fillings which carries values in gold and silver is found. The sand contains a small amount of gold. The percentage of this gold can be determined by a milling test, and such a test will be made as soon as a well is completed which will insure sufficient water for washing purposes. The first well drilled to a depth of seventy-five feet failed to produce enough water for washing purposes, so another well is being sunk. Preliminary tests made by the Raymond G. Osborne Laboratories show the pit contains 53 per cent material larger than 1 1-2 inches and retained on 1-4 inch and 32 per cent passing 1-4 inch. About 20 per cent of the material would be retained on a 4-inch screen and 33 per cent on a 3-inch screen.

The material is excavated by a 2 1-2 yard Bagley scraper operated by a 100 h. p. two-speed Thomas hoist. The scraper discharges to a pan feeder, which in turn feeds to a 30-inch belt conveyor. The belt conveyor, which is 156 foot centers, delivers to the scalping screen. The gravel is taken out here and discharged to an elevator which delivers to a scrubber, and then to a 42-foot screen where it is separated into the different sizes. The oversize goes to a 36-inch Symons disc crusher. The rock from the scalping screen is sent to the different crushers. The oversize goes to a 12x24-inch Cedar Rapids crusher and the 4-inch material to a No. 4 Allis Chalmers "Gates" crusher and the 3-inch material to the 36-inch Symons disc crusher. The crushers are so placed that any size from the scalping screen can be sent to any crusher, and all large sizes of material for which there is no demand can be returned from the long screens to be recrushed. The material passes through the crushers to a continuous bucket elevator, 18 inches wide and 80 foot centers, which delivers to a cen-

View From Bluff East of Plant. Plant is about 80 Feet High. A 30 inch Belt Conveyor In Foreground

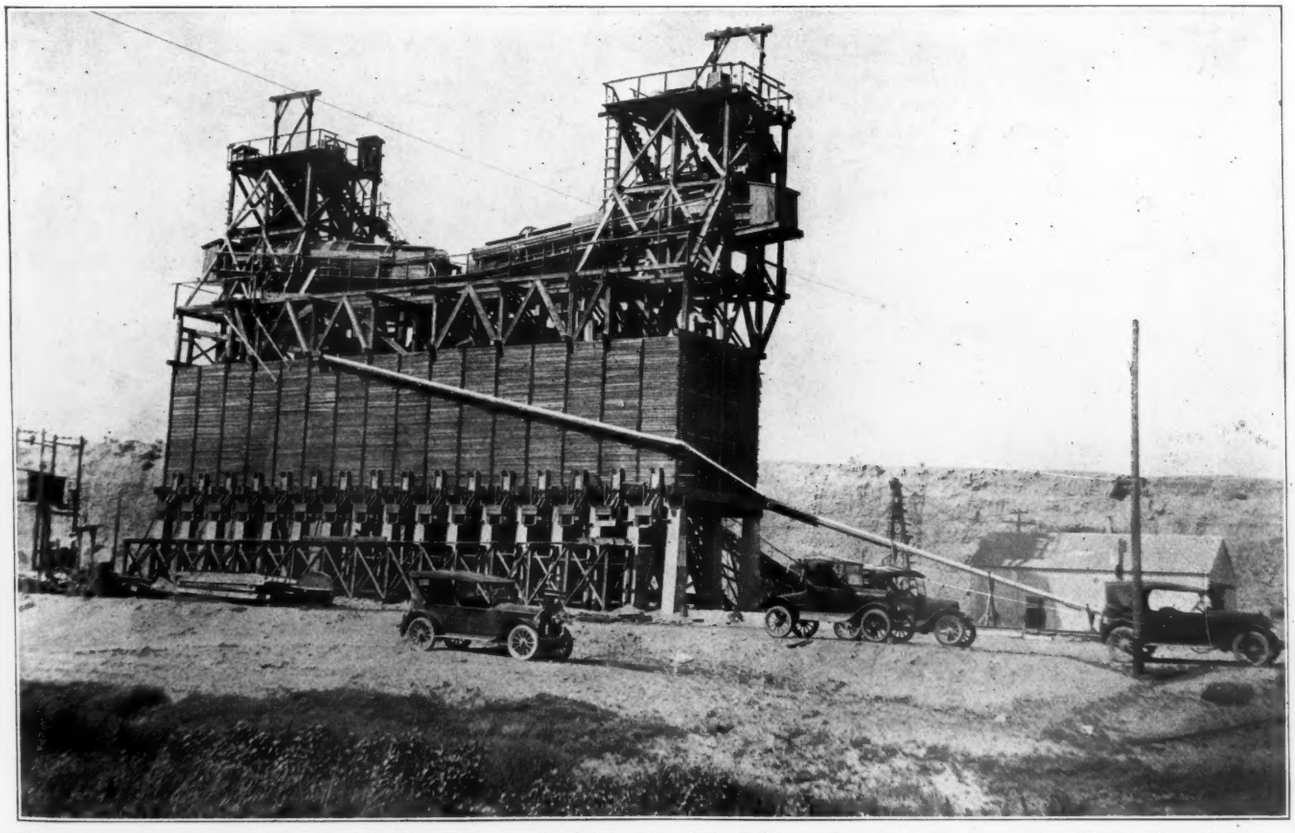


One of the 48 Inch by 42 Feet Screens. Gold Riffle at Left

trifugal separator and then to the 42-foot rock screen where the different sizes are separated. The oversize from this screen goes back to the Symons disc crusher. The sand, after passing over the gold riffles is sent to a Bodinson classifier for cleaning and grading.

The screens are of special design and were built by the Standard Boiler and Steel Works of Los Angeles. They are 48 inches in diameter and 42 feet in length. There are two such screens, one for gravel and the other for the rock. Both of these screens have 10-foot scrubber sections in the upper end. The scrubber section is a solid steel barrel, 48 inches in diameter and 10 feet long, built of 1-2 inch steel plate and containing a series of 10-inch screw flights with eight lifting flights placed between the screws in the circumference of the barrel. The next section of these screens contains 15 feet of 9-16 inch perforations, then three feet of 7-8 inch perforations, next three feet of 1 1-8 inch perforations, then four feet of 1 5-8 inch perforations, next three feet of 2-inch perforations, then four feet of blank space for gear and tire and finally 14 feet of wire cloth for the sand jacket. All perforations except the sand jacket are round. The scalper screen is 48 inches in diameter and 20 feet in length. This screen has six feet of 5-8 inch perforations, four feet of 1 1-2 inch perforations, four feet of 3-inch perforations, three feet of 4-inch perforations and blanks to cover gears and tires. At the head of each elevator there is a scrubber of special design, consisting of four manganese steel paddles set between two steel discs revolving at the rate of 400 r. p. m. These paddles cut the stream of material 1,600 times per minute.

The bunker foundation is 105 feet long, 4 feet wide and 4 feet deep. On top of this base are 34 columns, each containing 8 bars of 3-4 inch steel reinforcing running from the top of the columns to the bottom of the bunker foundation. The col-



The Screening and Storage Plant. Note the Gates on the West Side of the Bunker. Deposit in Background and East of Bunkers

umns are 36 by 24 inches at the base and 24 by 18 inches at the top. They are 14 feet in height. There are 17 columns to a side set 6 feet 4 inches centers. The bunkers are cribbed with 2x6 sides and ends which are tied every 6 feet 4 inches with 2x4 cribbed partitions, making a total of 16 pockets 20 feet high, 18 feet 6 inches long and 6 inches wide. The wall plates are 16x16 with 8x16 joists set edgewise and without spacing, except where a space of 12 inches has been left for the gates. The joists have a clear span of 17 feet. There are 16 slide gates in the bottom of the bunkers and 16 rack and pinion gates on the side. It is planned to install a 24-inch mixing conveyor belt, 160-foot centers, under the side gates for mixing and loading material to cars. All the equipment for this conveyor is on the ground and will be installed as soon as the scales are in place.

A vast amount of material has been removed with a steam shovel, leaving a bank nearly 1,000 feet in length with an average height of 40 feet. The plant has a capacity of 100 tons per hour and there is ample room for ground storage. The Bakersfield Rock and Gravel Company was organized and financed by C. F. Smith and the plant was designed and built by J. R. Hughes. The officers of the company include A. H. Karpe, president; J. B. Dowd, vice-president, and C. F. Smith, secretary-treasurer.

Big American Profit Makers

Statistics showing the trend of American business successes are available, indicating which industries are the greatest money makers. Of American corporations earning a net income of $10,000,000 or more last year, railroads are well up in the list. Net earnings of the Pennsylvania were $137,000,000; of the New York Central, $93,000,000; of the Southern Pacific, $62,000,000, with more than seventy others in the list.

The largest corporations of the United States with their total assets at the close of 1925 are as follows:

	Total Assets		Total Assets
U. S. Steel	$2,445,000,000	Armour & Co.	$486,000,000
Amer. Tel. & Tel.	1,645,000,000	Pub. Serv. of N. J.	438,000,000
Stan. Oil of N. J.	1,245,000,000	Stan. Oil of Ind.	406,000,000
Ford Motor	743,000,000	Texas Co.	398,000,000
General Motors	704,000,000	General Electric	397,000,000
Cons. Gas of N. Y.	661,000,000	Interborough Rapid Transit	381,000,000
North Amer. Co.	632,000,000	Stan. Oil of Calif.	374,000,000
Bethlehem Steel	617,000,000	U. S. Rubber	354,000,000
Cities Service	609,000,000	Sinclair Cons. Oil.	352,000,000
Stan. Oil of N. Y.	534,000,000	Swift & Co.	342,000,000
Anaconda Copper	494,000,000		

Among the large profit makers, no lumber, coal or mining company is found. There are few food industries, machinery manufacturers and automobile companies. Oil companies, however, stand high in the list, due to the oil and gasoline demand. There are representative profit makers in many of the industries showing that many lines of business have attracted great masses of capital and have involved large scale production.

General View of Plant. Also Method of Dragging Material to First Crusher and Belt Conveyor

IS PULVERIZED COAL PRACTICAL IN SMALL PLANTS?

By H. C. Shields

WHILE the subject of pulverized coal is far from being new, it has been the opinion of small power users, until very recently, on account of the expense that seemed necessary in the matter of large central preparation and pulverizing plants with their preliminary crushing, drying and preparation costs incident thereto, that this fuel could not be commercially utilized in smaller plants and should only be considered in plants of 5000 h.p. and upward.

Within the past two or three years so many improvements have been made in various types of pulverizing equipment and methods of application, proper mixing of the coal and air prior to its entering the furnace and the distinct economy obtained therefrom over stoker and hand firing, that the use of pulverized coal may be safely said to be now beyond the experimental stage and the resultant economy and success depends largely on the selection of proper equipment and its proper installation.

One of the better ways to acquire actual facts on this important subject would be for the small power producer and user to make a personal visit to operating plants and after a careful study, draw their own conclusions, one of the other ways being to employ an unbiased reputable engineer who is familiar with the advantages of pulverized coal and follow his recommendations. Power engineers and executives who have installed powdered coal are very often inclined to overestimate actual savings and become overenthusiastic, when approached on this subject and are inclined to tell the good features of their own particular system in order to substantiate their own judgment, while frequently a talk with the actual operator may disclose unfavorable operating conditions with some of the older and more complicated systems.

Special Equipment Needed

The use of pulverized coal in any industry necessitates special preparation machinery, and frequently a special building for housing same, depending on type equipment used. Before deciding on the installation, careful operating records should be taken covering present practice and against this data the great possibilities of pulverized coal, and it may be safely and conservatively stated, that under all ordinary conditions pulverized coal may be substituted for stoker or hand firing and the savings thereby effected will within a short time amortize the cost of the pulverized fuel installation.

The preparation of this form of fuel has now resolved itself into a very simple and inexpensive process. Where slack coal is obtainable there seems to be no use for installing preliminary crushing rolls however in some instances where a constant supply of fine coal cannot always be depended on, crushing rolls should be considered. The ideal installation would therefore consist of a receiving track hopper, rolls, elevator to raw storage, unit pulverizer, fan, mixing apparatus, burner and delivery pipes to same, under ordinary conditions no dryer being required.

The grinding of a cubic inch of coal to extreme fineness will increase the surface exposure from six square inches to approximately 1800 square inches and therefore by fine grinding we have increased the velocity of combustion approximately 300 fold. By doing so we have immediately changed the characteristics of the fuel. Much has been said and written concerning the proper fineness to which coal should be ground and a set standard of 85 per cent passing the 200 mesh sieve has been considered good practice. It is however the writer's observation, constant uniformity of fineness and a grinding of 90 per cent fine through the 200 mesh sieve will produce better and more economical results. The extremely fine grinding produces a new type of fuel which has in it inherent possibilities not met with in slack or coarsely ground coal. By increasing the surface exposure over 300 fold we have speeded up combustion proportionately. This carries with it a further effect, the increase in combustion velocity which also increased the temperature of the rest of the material. This temperature rise, which is more rapid than in the normal combustion of coal will double the velocity of combustion each rise of 10 degrees C. These temperature rises are superimposed on each other so that we have with pulverized coal, a combustion which is hundreds of times faster than when burning coarse coal.

More Than Fine Grinding Necessary

Fine grinding alone will not assure success in the utilization of pulverized coal. Aside from this the coal and air must be intimately mixed or carburetted prior to its entering the furnace so that each small particle of coal is surrounded by the proper amount of air. In this condition, by maintaining the proper velocity of air current, the mixed fuel can be carried into the furnace in suspension and there burned completely, efficiently and rapidly.

It is of course a simple matter to mechanically control the amount of powdered coal delivered to

the furnace in a given time. It is also quite possible to control the amount of air delivered with the coal. If we then deliver to the furnace an intimate mixture of air and powdered coal and have control of the amount of coal dust and air delivered, we have the prime essentials for highest combustion efficiency and these are the possibilities in utilizing powdered coal for fuel. A careful study of the methods for making such a mixture shows the older methods employed in attempting to make such a mixture were wrong, as in making a uniform mixture of two miscible solids or a uniform solution of a solid in a liquid, the methods previously used in mixing finely ground solids were not only useless, but actually separated the coal dust from the air.

Ordinary mixing is done by agitation; this agitation is usually accomplished by baffling, stirring, shaking or similar devices. When, however, such methods are applied to a mixture of gas and finely divided solids, the solids tend to separate due to their much higher specific gravity. This, in fact, is the principle of the well known cyclone dust collector. Any mixing device which results in such agitation of the dust and air as to give a centrifugal effect will tend to separate instead of mixing the air and dust, and any mixing device along these lines must necessarily fail to give an intimate mixture.

It is the writer's opinion that perfect and proper combustion is entirely dependent on the intimacy of this mixture prior to its being projected into the furnace and the rapidity of combustion depends largely on this being properly accomplished. This is well illustrated by comparing the ordinary gas flame obtained in the Bone Combustion System. As you are aware portions of the air and gas in this system are forced through a diaphragm in proper proportions, this diaphragm having numerous small openings or interstices, which results in a mixture that is nearly perfect. When this mixture is ignited on the other side of the diaphragm, we have only a film of flame. This system however, cannot be applied commercially and therefore other methods must be used.

Large Furnace Areas Not Necessary

The poorer the mixture the longer the flame. The flame simply outlines the area in which combustion is taking place and the length of the flame is a measure of the time in which combustion is taking place and completed. This time element, other conditions being equal, is absolutely a function of the intimacy of the mixture. Evidently, the length of the flame not only depends on the nature of the combustible, the excess of air and the nature of the combustible, the excess of air and the rate of firing, but also to a large degree on the rate of mixing of the combustible gases with the oxygen of the air. It has also been proven that the tendency of these gases is to flow in parallel streams through the furnace. And it may be further said, that when this intimate mixture is accomplished, ignition will take place immediately at the orifice of the burner, provided the mixture is projected into the furnace at the proper velocity. This immediate ignition starts the process of combustion and it is therefore very evident, under these perfect conditions, that the very large furnace volumes or areas heretofore thought necessary for the proper burning of powdered coal, are quite unnecessary if the fuel is properly prepared prior to its being blown into the furnace and as a matter of fact recent modern applications have proven this form of fuel may be successfully burned in practically any boiler furnace upon removal of the stoker or hand-fired grates with but little modification of the present furnace arrangement and these facts must prove of interest especially to the small power plant owner who has heretofore thought the enlargement and complete rebuilding of their present furnaces necessary before this form of fuel could be successfully used.

The burning of finely solid fuel in suspension has been long recognized as the way in which the nearest approach to theoretically perfect combustion that could be reached in every day practice. Combustion is a chemical combination or reaction between the combustible constituents (carbon and hydrogen) of the fuel and oxygen, accompanied by the production of heat. Perfect combustion is obtained when the combustible unites with the maximum possible amount of oxygen, one atom of carbon uniting with two atoms of oxygen to form CO_2.

Amount of Oxygen Important

If less than this amount of oxygen is present or the processes of combustion are carried out in such a manner that the complete oxidation of the fuel is not possible, even though the total amount of oxygen be present in excess of that actually needed, the combustion is incomplete, one atom of carbon will unite with one of oxygen to form CO and a very serious heat loss is caused; the amount of heat generated when carbon is burned to CO_2 being almost three and one half times greater than heat produced by partial combustion to CO only. The time a combustible particle of fuel remains in the furnace is very short and very frequently entering the furnace at velocities from 8000 to 10,000 feet per minute, under the older practices, and combustion must be completed during this period or never. For instance when the gaseous or solid products of combustion under a stationary boiler first encounter the tubes or sheets of the boiler itself, much of their heat is extracted, principally by convection and their temperature lowered below

that at which they can rapidly combine with more oxygen. If, therefore this combination was not complete before these cooling surfaces were reached, the combustion process is at once arrested, and the gases continue to lose heat during their entire passage through the boiler, completion of the process can never occur, resulting in a great loss of heat, and entailing, for the same work done by the boiler, the consumption of considerable extra fuel to compensate for this loss.

It is evident from the above that if, at a very early stage in the travel of the fuel through the furnace, there is an intimate mixing between the combustible and a sufficient amount of air to supply oxygen, and no more, complete combustion is more apt to occur then, than if these conditions do not exist. It follows further that if the solid part of the fuel is ground to extreme fineness, rapid and complete combustion will immediately take place which can and does not occur in stoker or hand firing, and further if these very fine particles of fuel are well mixed with oxygen and are allowed to chemically combine with it as they float through the furnace, burning in suspension, the oxidation of the combustible will be much hastened and complete combustion attained, all of which means the volatile contents of the coal have been correctly mixed; oxygen and heat units are produced with elimination of the smoke, and as previously mentioned we must first properly prepare the coal by extremely fine and uniform grinding and at the same time mix it with the proper amount of air and by ejecting this mixture into the furnace at low velocities ideal furnace conditions can always be maintained.

The Tube Mill

The tube mill has always been considered an efficient and economical machine for the reduction of refractory materials, its construction being a steel cylinder of varying lengths and diameter, to suit conditions, slowly revolving on trunions and loaded with proper charge of steel balls, the mill being lined with rough metal plates the effect of these being to act as lifters raising the load of balls and material to a point above the center line where they start to cascade and fall back thereby breaking up and grinding the material therein. This type of mill is usually loaded with a very heavy charge of small diameter steel balls and the intimate and constant contact of these on the material to be ground quickly reduces the material to a very fine powder, the tendency always being for the finer particles and impalpable powder to rise to the top of the mill. The recent improvements in this type of mill whereby currents of air are introduced, making the mill air-swept, have enabled the manufacturers of this type of pulverizer to take from the mill a uniform finely ground product at the same time mixing it with the proper amount of air all of which has resulted in a perfect and economical method for the proper preparation of this form of fuel for the furnace.

In the earlier stages of attempting to burn pulverized coal not sufficient attention was given to very fine grinding and the chemical composition and structure of the coal itself, and in many instances the coal was not ground fine enough to separate the combined iron, sulphur, silica and other inert materials from the combustible material in the coal and sufficiently fine molecules of distinct and separate carbon were not thereby produced in sufficient quantity to support combination. When this heterogeneous mixture was blown in the furnace it was found necessary to use high velocities and furnaces of extra large areas to afford sufficient time to prepare the carbon for gasification while passing through the fire box. These high velocities brought about an impingement of a very high temperature flame against the bridge walls and refractories thereby quickly destroying them. In some cases water screens have been installed to overcome this destructive effect.

Probably the greatest grief experienced in the earlier attempts to burn pulverized coal was due to trouble from slagging and fusion of ash and this was primarily due to lack of knowledge and experience in the proper methods of preparation and introduction into the furnace. Proper preparation of the fuel, correct furnace design, mixing of the coal and air prior to its entering the furnace, low velocities, correct furnace design, correct amount of air admitted to support combustion, proper location of points of air admission, temperature zoning and other improvements have practically eliminated this trouble. The ash produced from the proper burning of pulverized coal is free from all combustible matter, a very fine flocculent powder, thoroughly calcined and containing no smudge. Careful observation of several modern plants shows, from 25 to 50 per cent of the ash remains in the combustion chamber, 5 to 12 per cent is collected in the second and third pass, 25 per cent is lodged in the stack base and the balance is carried up the stack, this stack emission does not however, present any serious problem, as the ash thus emitted is very fine and is dissipated into the surrounding air currents.

Destructive Flames Eliminated

Recent and improved practices have eliminated the heretofore destructive impinging flame on the bridge walls and furnace refractories so that the deterioration of brick work that was looked upon as inherent in powdered coal burning has been overcome, and it is now found in general practice that not only is the cost of repairs lower than with stoker firing, but that the boiler work general costs have been greatly reduced due to the more uniform furnace conditions. Commenting for a moment

on the maintenance features especially as to furnace upkeep, it is the writer's opinion that the refractories in a pulverized coal furnace will outlast the refractories in a stoker fired furnace approximately 25 per cent and this is largely due to the more even temperature maintained in the powdered coal fired furnace, in fact I have recently inspected several powdered coal fired furnaces that have been in continuous service for over two years and the refractories still in good condition and one furnace where the boiler is operated at 300 per cent of rating for a period of three years without renewal of brick work. Fire brick becomes plastic below the melting point, yet they will retain their shape unless subjected to undue pressure and high velocities of gases when subjected to temperatures ordinarily required for high combined efficiency. Absolute control of furnace temperatures prevents to a great extent refractory troubles and consequently reduces furnace maintenance.

With reference to the advantages of burning coal in powdered or pulverized form chapters could be written in its favor, however the subject can be summarized by mentioning some of the more salient points. Practically all and any grades of coal can be burned and are usable in powdered form and can be utilized with economy, thereby always affording a far wider variation in quality of coal usable. No stoker will satisfactorily handle all grades of coal, therefore the use of pulverized coal will largely overcome most of the troubles due to poor coal and it is particularly desirable for this reason alone. Considerable less excess air is required for complete combustion. This item is of utmost importance when making comparison; less excess air means less power for furnishing air supply, particularly where forced draft is used and with less excess air the stack losses are less. An air supply sufficient to furnish all the air for combustion should be available, although at times only 50 per cent of the air is necessary to be injected into the furnace with the coal, the balance being supplied by induction or drawn in by the stack draft, the air going into the furnace should be under full control so as to permit close regulation under all conditions of firing as less draft is required for pulverized coal firing. There are no moving parts or mechanism in a pulverized coal fired furnace, therefore no renewals to be made or can there be any clinkering on the grates as there are no grates to keep in repair. All the combustible in the coal is burned, therefore fires are eliminated in the ash pile. The writer might state at this point, many ash piles observed showed as high as 40 per cent combustible in the ash. The furnace equipment with tight doors can be closed and sufficient heat remain in the setting to ignite the coal when starting up again after a shut down of a number of hours, this is a condition that cannot be obtained by stokers, for if the doors are closed gas is liable to generate and liability of explosion. A pulverized coal system is much more flexible than a stoker installation, approaching that of oil or natural gas, thus insuring its ability of taking care of varying loads, and particularly adaptable when sudden peak loads are required, and the ease with which high peak loads can be dropped and minimum loads be maintained, all of which cannot be accomplished with stoker or hand firing without serious loss of fuel. With this form of fuel all standby losses are avoided, there is no banking of fires, fuel is only consumed when needed. By throwing a switch the entire firing operation ceases, an advantage in case of accident or emergency.

Boilers of practically any type or size can readily be arranged for pulverized coal firing, but those containing the smallest percentage of space for the lodgment of ash are preferable. Vertical baffles should replace all horizontal baffles where possible.

The investment required in a pulverized coal plant and burning equipment, when using the improved "unit system" is considerably less than required for a first class stoker installation, and with the modern equipment now to be had, it may be safely stated, the savings effected by the use of pulverized coal, with the proper selection, installation and intelligent utilization of same, will amortize the original cost of such equipment within a very reasonable length of time. The pulverized coal age is here to stay, for this method of firing represents the first step taken towards burning coal in a scientific manner. It seems needless, therefore, to reiterate that with the advantages apparent by burning coal in this form, its ultimate adoption as a standard method of firing in large and small plants is only a question of time, and in all power plants where improvements are being projected and developed along lines that make for greater efficiency and economy, these are reflected in the increasing availability of labor saving devices, which all in turn makes for better civilization by eliminating more and more of the drudgery of the world's work.

Municipal Ownership Wanes

Municipal ownership of electric light and power has apparently not found favor. Statistics furnished by the Illinois Committee on Public Utility Information show that 95.1 per cent of the electricity sold in the United States is produced by private companies and 4.9 per cent, by municipal plants. Privately owned plants increased 34 per cent from 1902 to 1922, while municipal plants increased 217 per cent during that period. Between 1923 and 1925 it was necessary to abandon operation of more than a thousand plants.

THIS COMPANY IS BUILDING AN INSTITUTION IN THE LIME AND STONE BUSINESS

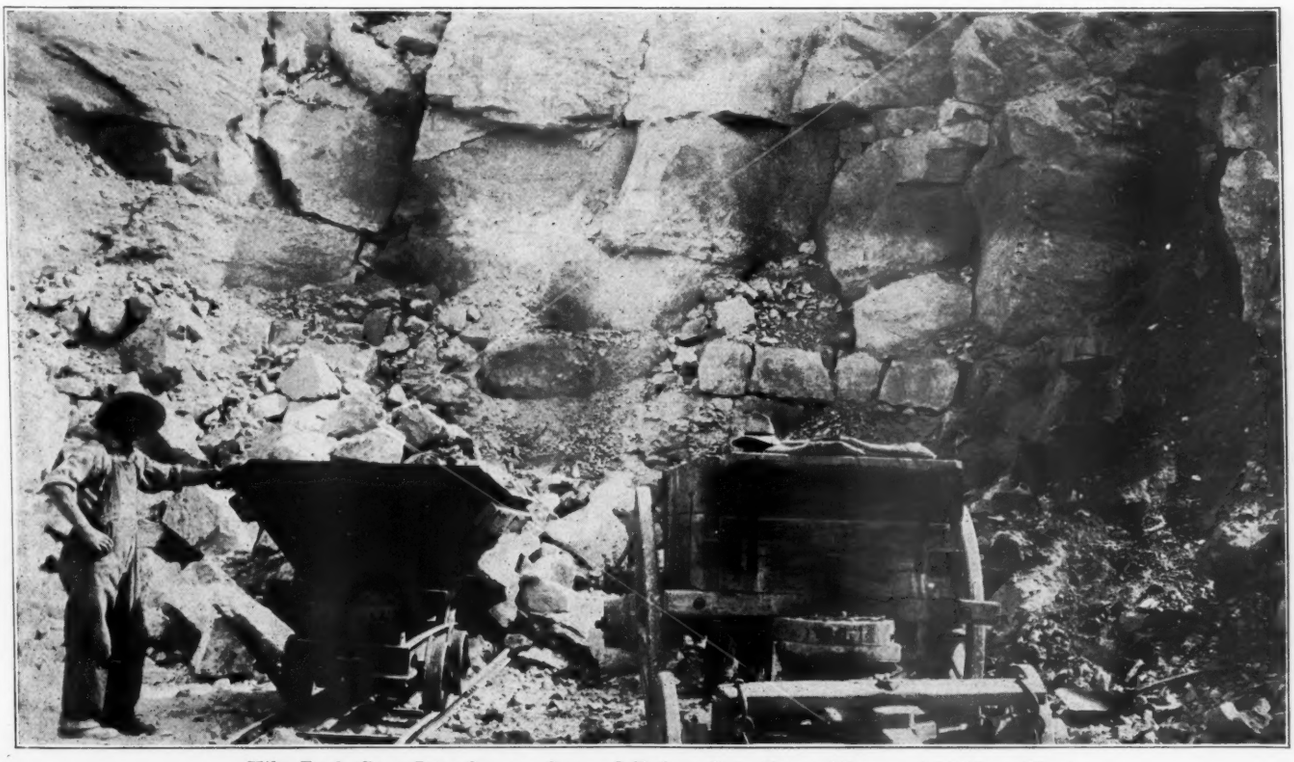
By E. D. Roberts

EVERYONE will agree that an industry having a diversity of interests is better able to withstand depressions than one which specializes in a particular article or commodity. It was this fact that recently caused the Standard Lime and Stone Company of Fond du Lac, Wisconsin, to abandon the manufacture of lime at their Oakfield, Wisconsin, plant and start the manufacture of tile and brick products with this unit of the company.

The step was brought about quite by accident. While prospecting their site at Oakfield for additional lime for the operation of the two kilns then operated, a deposit of shale was found which was found to be of ample size and of the right quality to justify the installation of a tile and brick plant. Building and drain tile were first produced, after which the production of building brick was attempted. The brick found ready sale with the contractors, which justified the company to add to their line by putting out a face brick.

Eastern Wisconsin is underlaid with a deposit of high magnesium lime in various thickness. This deposit is known as the Niagara limestone, which the geologists say was laid down by the accumulation of fossils and other materials in the bottom of a prehistoric Lake Niagara. Due to the difference in the fossils, this limestone varies in different localities, and it is for this reason that some sections are overrun with lime kilns, while in other sections, underlaid with apparently the same stone, kilns are scarce. Of course, all the lime manufactured in Eastern Wisconsin cannot be marketed there, and the producers depend on such cities as Chicago, St. Louis and other large cities nearby to take their surplus.

The Standard Lime and Stone Company now operate 9 kilns, 5 at their Valders, Wisconsin, plant and 4 at their Knowles, Wisconsin, plant where they are now building an additional kiln. As the market for lime is seasonal, and as it will not retain all of its life if stored for any length of time, also as the efficient operation of a kiln depends upon its continuous operation, a hydrating plant was installed at the Knowles plant to hydrate the lime during slack periods and thus keep a steady production of the kilns. During slack season, orders for lump lime are filled from the plant not having the hydrator, while the production from the kilns where the hydrator is located is hydrated and stored ready for sale when there is a demand for lime. The increasing demand for Limate, which is the trade name for the hydrated lime, has favored this method of joint operation of several plants, thereby attaining added efficiency.



Kiln Rock Goes Into Quarry Car and Refuse Into Dump Wagon at Valders Plant

With the addition of the brick and tile plant, the Standard Lime and Stone Company finds itself in a strong position to supply most of the needs of the building contractor. Their present products are lump lime, limate, ground lime, building and face brick, building and drain tile, crushed stone and agricultural stone. A crusher unit at the Valders plant produces crushed rock from the spalls and chips left after the kiln stone has been sorted from the quarry rock. Considerable interest is being awakened among the farmers in the use of lime to enrich their soil or change its composition chemically so that it will produce better crops, and the spalls and chips are ground for this purpose. Most dealers require that the agricultural stone, called "agstone," be dried, and to meet this requirement, the company intends to make the installation of a mechanical dryer.

The Valders and Knowles plants of this company are over 30 miles apart, and yet analyses of the rock from each quarry shows a market similarity.

Mr. A. S. Mitchell, the Wisconsin state chemist, gave the following report on a representative sample of rock from the Valders Quarry:

Calcium carbonate (carbonate of lime)	54.34%
Magnesium carbonate	44.39%
Silica	0.24%
Ferric oxide (oxide of iron)	0.38%
Alumina	0.20%
Total	99.59%

The Wisconsin State Geological Survey made the following report on their findings on a sample taken from the Knowles Quarry:

Carbonate of lime	54.740%
Carbonate of magnesia	45.070%
Silica	0.022%
Alumina and iron oxide	0.005%
Total	99.837%

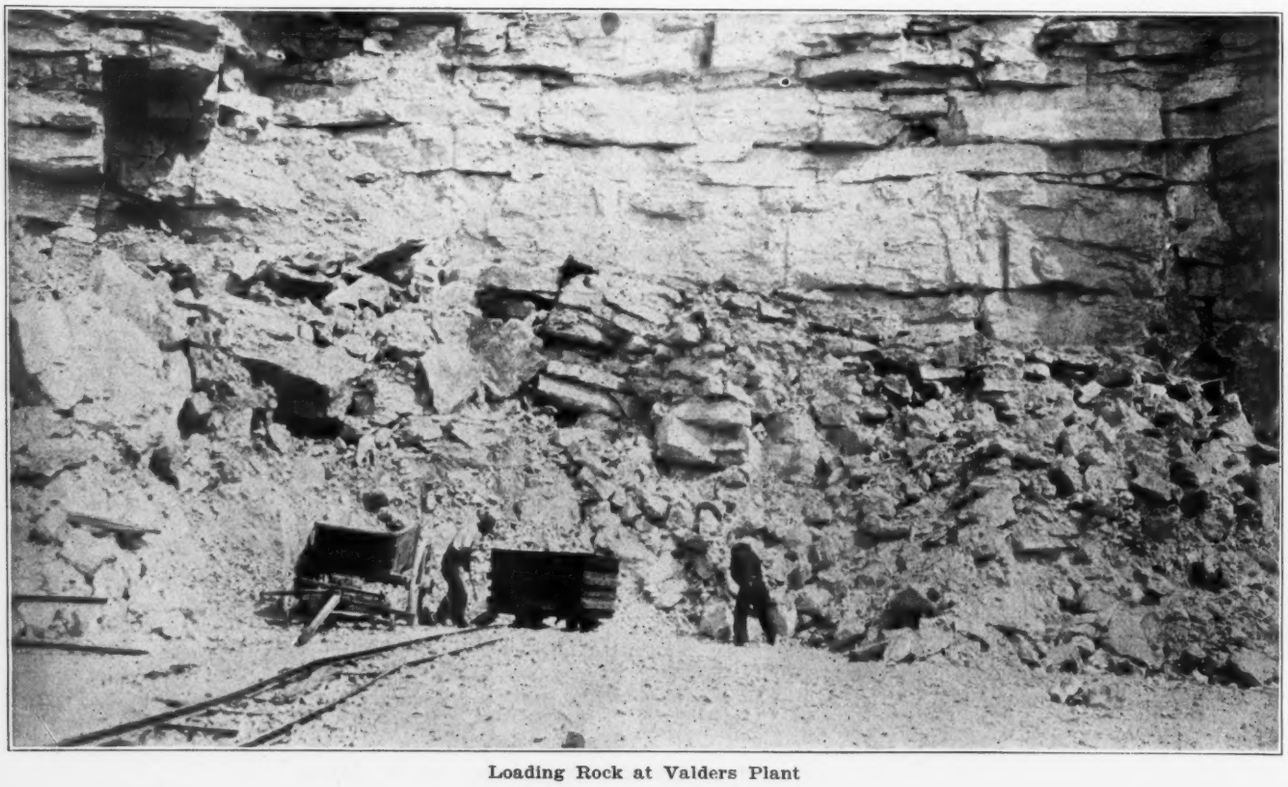
Mr. W. A Titus is president and treasurer of the Standard Lime and Stone Company, with headquarters at the Fond du Lac office of the company; Mr. Otto Freerick of Chicago is vice-president, and C. Czarneski is secretary. Mr. George Clifford, who lives at Knowles, Wisconsin, is general superintendent and looks after the production of the various plants.

Aside from his duties as president of the company, Mr. Titus finds time to indulge in politics, having served several terms in the Wisconsin State Legislature as senator, and the collection of rare signatures.

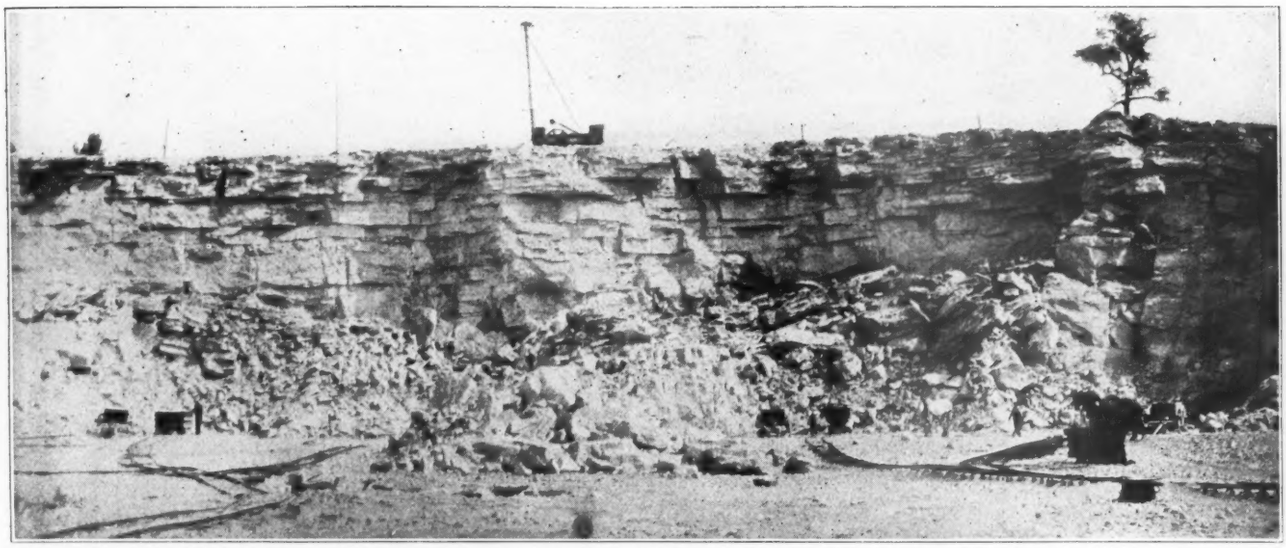
The Valders Plant

Although called the Valders Plant, it is not located at Valders, Wisconsin, but at Quarry, a station of the Soo Line, about 3 miles west of Valders. The principal features of this plant are the five kilns and the rock crushing plant. Two of the kilns are set out by themselves, being the first installation, while a battery of three is placed so that the tracks serving the kilns also elevate the rock to the crusher plant.

Most of the lime deposits in Wisconsin average from 25 to 30 feet in depth, but here we find them working on a 60-foot face with a proven 20 feet additional depth. The present working floor is



Loading Rock at Valders Plant



The Quarry Face at Valders Plant

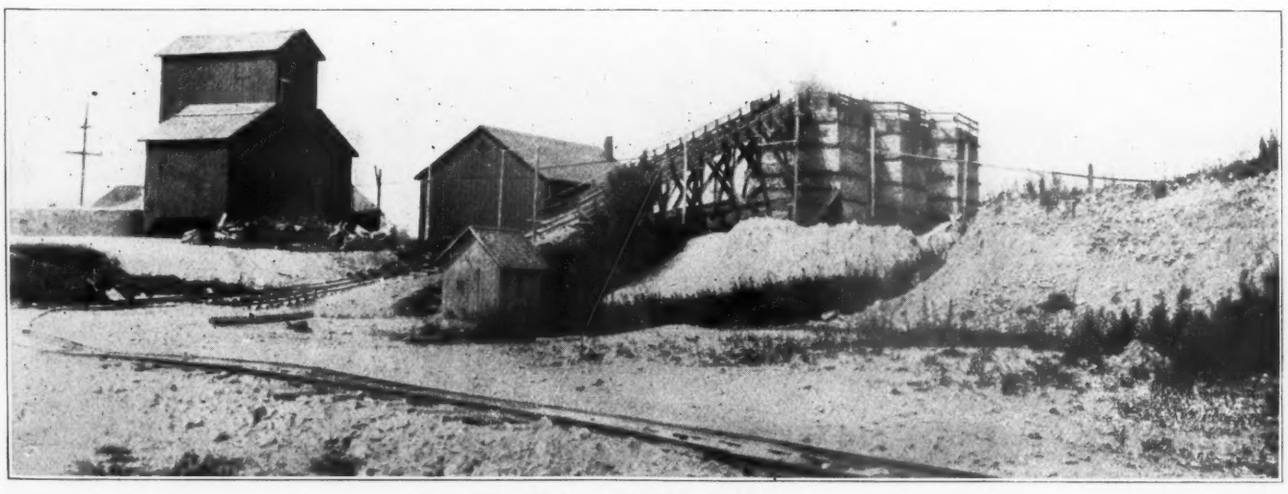
above the lowland close by which eliminates water troubles in the pit. It is also noted that two lime companies are working in the same open pit, there being no dividing wall between the workings of the Standard Lime and Stone Company and the Western Lime and Cement Company whose quarry plant is located within a few feet of the Standard's.

Well drill holes 5 inches in diameter are put down by a Sanderson cyclone well drill 16 feet from the face and 16 feet on centers. As the holes are dry, du Pont black powder is the only explosive used for the blast. The charge is placed at the bottom which shoots out the lower part allowing the upper part to fall in. Ingersoll-Rand jackhammer drills are used to place holes in the large pieces not broken up in the big shot. Air for these drills is furnished by an Ingersoll-Rand air compressor number E-R-1 which is driven by a 10 h. p. Imperial motor.

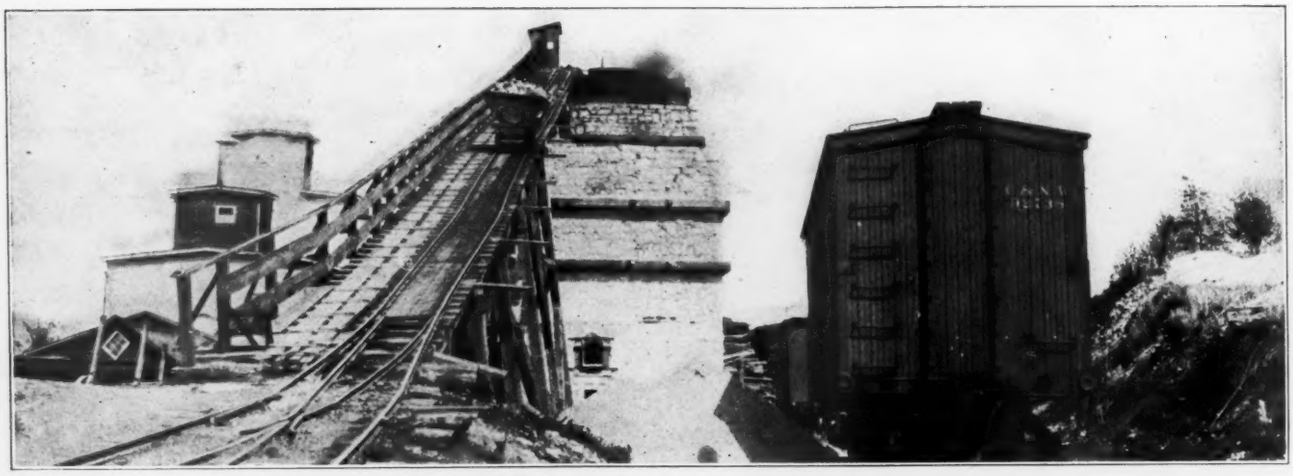
The stone is hand-picked and loaded into Atlas side dump cars which are drawn to the foot of the incline leading to the top of the kilns by a horse. During the winter months, the fines are left to accumulate in the pit, but during the summer months these are reclaimed and crushed for road mending or concrete aggregate.

Due to the location of the kilns, two inclines are required to raise the stone to the top, and two hoists are required to draw up the cars. Both of these hoists were made by Fairbanks-Morse Company and are operated by 15 h. p. Imperial motors with a remote control from the top of the kilns. The kilns range from 42 to 46 feet in height and are of the square masonry type. Wood is used for burning which is shipped by railroad from northern Wisconsin. As the kilns were built on the sidehill, advantage was taken of this to have a firing floor of dirt, claimed to be the safest from the viewpoint of fire hazard, as sparks that fall on it will not blow around as freely as if the floor was constructed of concrete. Grates have been placed in the bottom of the kilns to allow the fines to fall through, thus leaving the large material ready for drawing out into the wheelbarrows.

Most of the lime is shipped in bulk in wooden box cars, and this requires that the lime remain in



The Plant at Valders, Wisconsin



Car Going Up Incline to Kiln at Knowles Plant

the wheelbarrows until cool, after which it is wheeled into the car. If the shipments are to be made in steel drums or wooden barrels, the lime is dumped onto the firing floor to cool before packing. The bulk lime is not weighed into the cars, as the company has provided a Howe track scale for this purpose. The cars are weighed before spotting and again after loading.

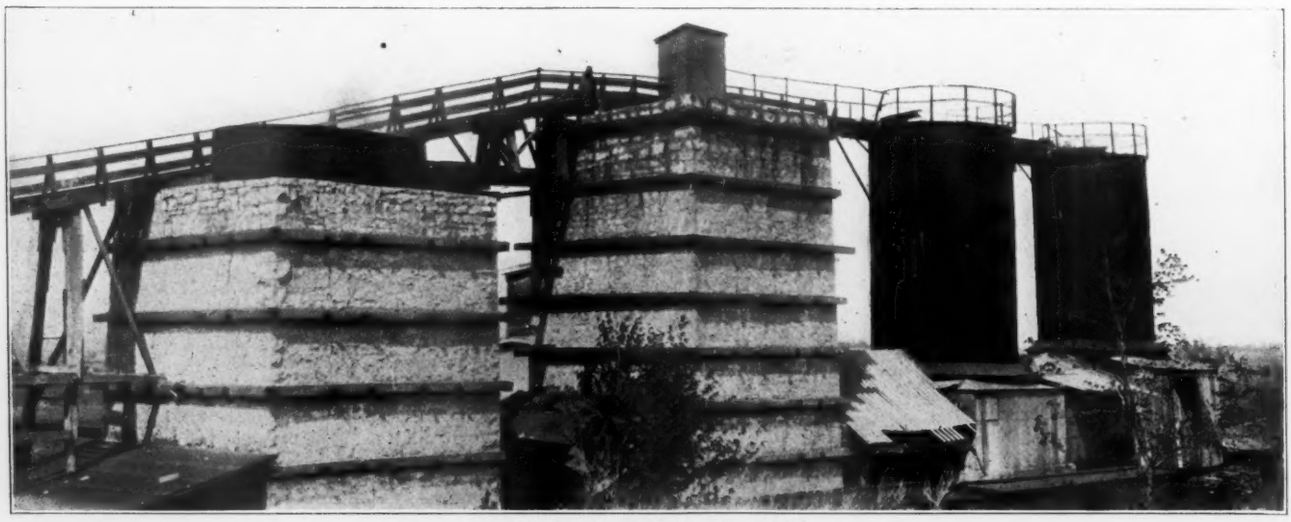
The crushing unit is composed of a number 5 Austin gyratory crusher into which the spalls are dumped directly from the cars. After crushing, the material is discharged into a bucket elevator which carries it to the top of the bins where it is discharged into a screen composed of a set of concentric screens, each a trifle shorter than the other so that the whole screen is but 12 feet long and yet gives three grades and rejects. The screen and elevator are driven by an independent motor, while the Austin crusher is driven by a 30 h. p. Imperial motor, all the motors of the plant operating on a 440-volt current. Mr. T. L. Norton is the foreman of the plant.

The Knowles Plant

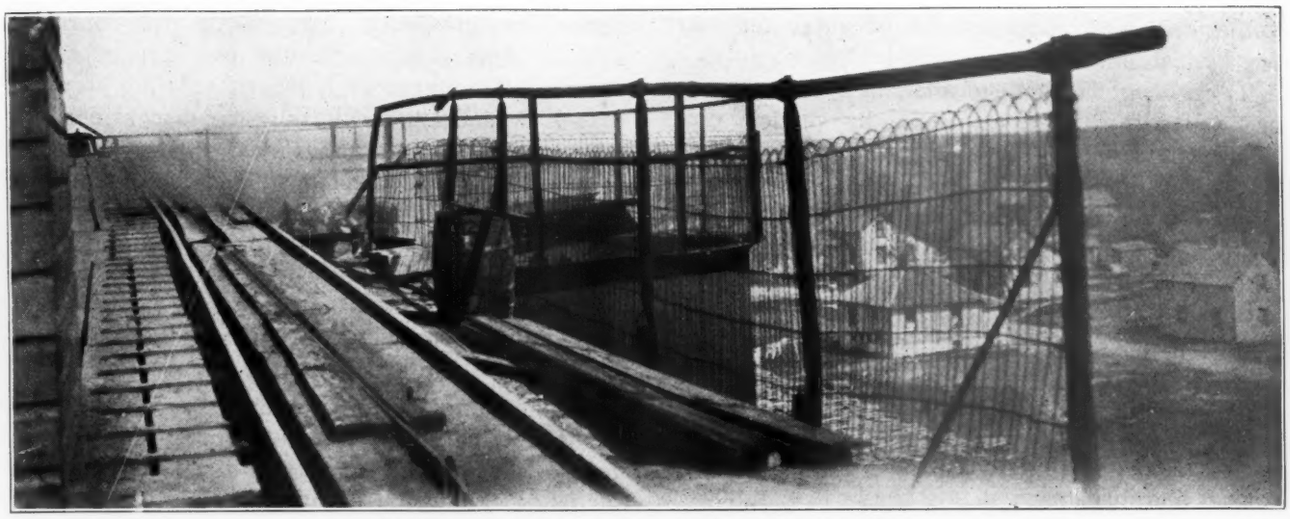
This plant was started 20 years ago with two steel kilns. Later two stone kilns 6x8x55 feet in height were added. At present a fifth kiln is being added, which is of stone construction and built up in line with other kilns as far as possible without changing the incline track. This is necessary as the present urgent demand for lime will not allow a shut-down of operation of the old kilns long enough to change the inclined track. The new drawing room has a clear span roof held up with steel trusses supported by the kiln at one end and a brick wall along the loading track side.

This company favors stone kilns as against steel kilns on account of the thick walls of the former which allow less radiation than steel shell kilns. E. P. Green's fire brick is used for lining the new kiln as well as the old ones. A hydrating plant was constructed to meet the demand for this kind of lime, as well as caring for the kiln output in case there should be a shortage of cars.

The deposit is Niagara Limestone about twenty feet thick overlaid with from one to three feet of soil. The dip of the strata is towards the east and the limestone is at such a height that the pit is drained by a short trench, thereby eliminating the necessity for pumping. The overburden is removed by a Lessman loader attached to a Fordson tractor.



The Kiln at the Knowles Plant



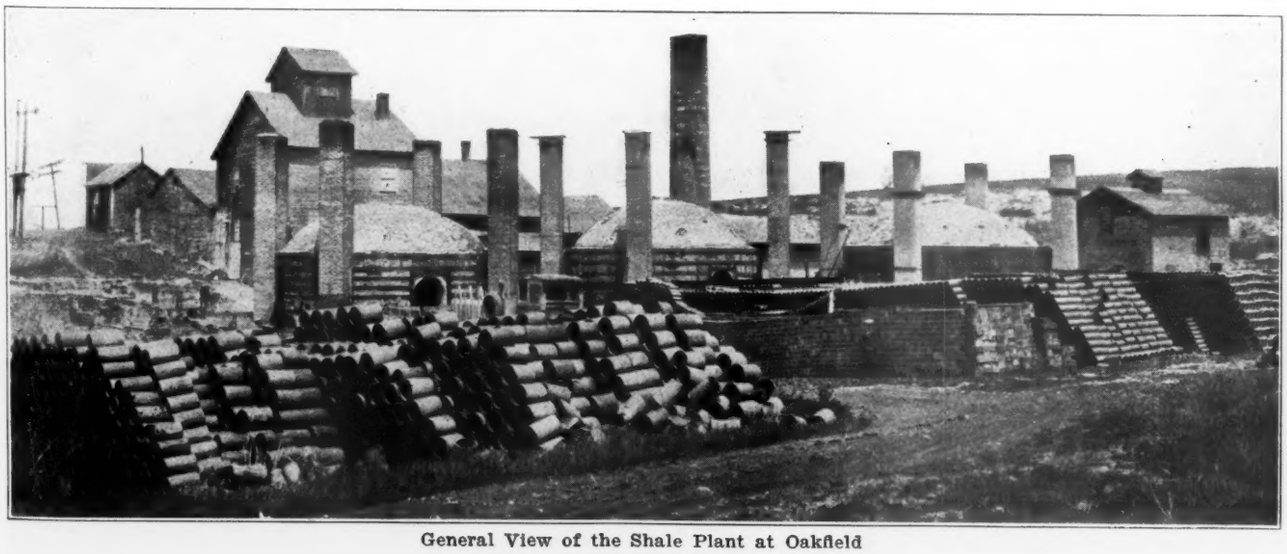
The Dumping Track on Top of Kiln at Knowles Plant

This loader, which is a sort of loading shovel, digs the dirt and dumps it into a center dump wagon. The Fordson is then backed up to the wagon, and hauls it away to an abandoned section of the quarry.

A Sanderson Cyclone well drill provides the holes for shooting the limestone. A small charge of du Pont 40 per cent gelatin loosens the rock for loading into cars. This loading is done by hand so that only large pieces of rock will be taken to the kilns in Atlas 2-yard side dump cars. The spalls are loaded into center dump wagons and sold to the county for road building. A horse hauls the loaded car to the foot of the incline, up which it is hauled by a hoist operated by a 20 h. p. Imperial motor. The car is then stopped over the top of the kiln to be loaded, a chain is fastened to the car and the contents are then dumped by hand directly into the top of the kiln.

After burning, the lime falls or moves down into a cooling chamber below the burning zone. A grating constructed in the bottom of this cooling zone allows the fines to fall through into a pit. These fines are removed and sold to the farmer for fertilizing purposes. The lump lime slides to the back of the kiln and is drawn out directly into wheelbarrows. The lime is sufficiently cool so that it can be loaded directly into box cars without danger of burning them. However, as the placing of hot lime in close cars has been found not beneficial to lump lime, the wheelbarrows of lime are left standing loaded for a time for further cooling. There is some demand for lime packed in steel drums, but most of the shipments are made in bulk.

If the lime is to be hydrated, it is wheeled into the hydrating house located across the loading track from the drawing room. A Sturtevant pulverizer set with the top of the hopper level with the floor receives the wheelbarrow of lime and reduces it to 1-4 inch or finer and discharges it into the boot of a 6-inch bucket elevator which conveys the ground lime to the top of the building and discharges it into a 12x14x14 foot storage bin. From the storage bin, it is drawn into a weighing hopper from which it is discharged into the hydrator to-



General View of the Shale Plant at Oakfield

gether with the proper amount of water necessary for hydration.

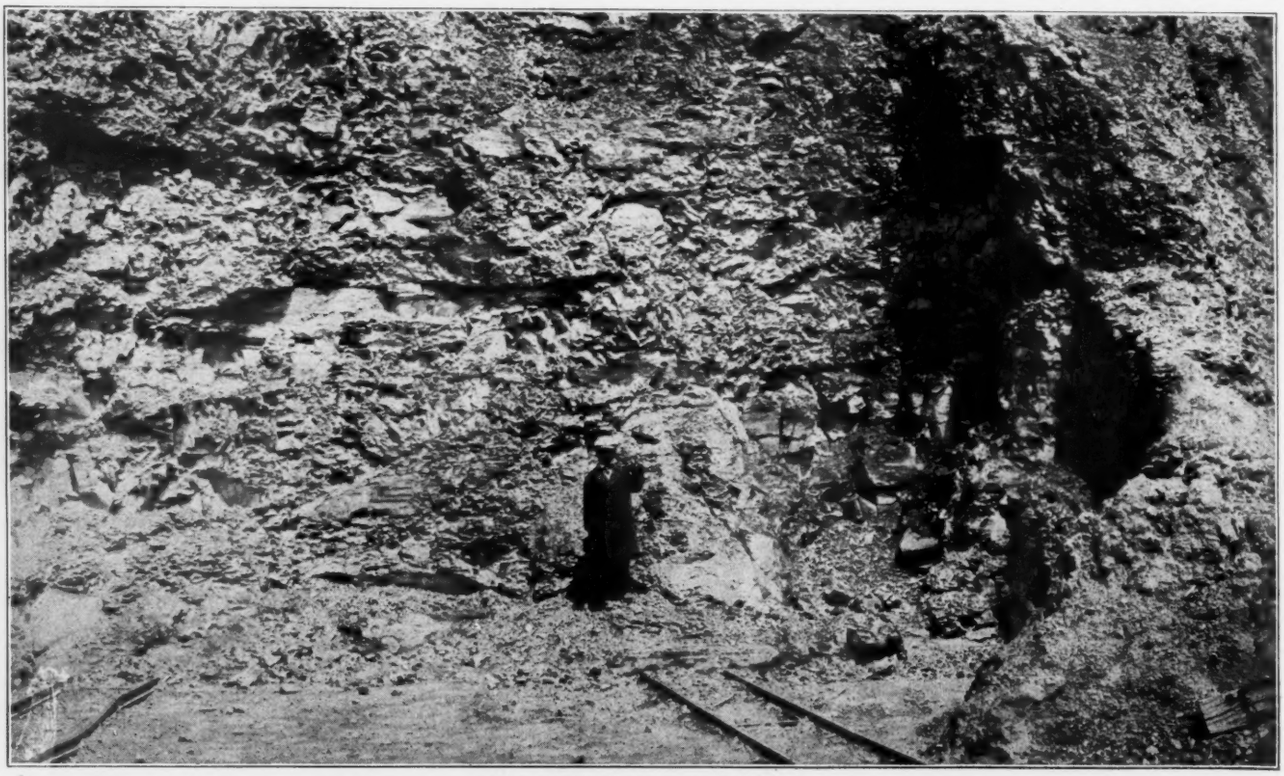
The hydrator is made of a tier of cylinders placed one above the other, connected by vertical pipes at alternate ends. Revolving paddles constantly work the lime and at the same time force it through any particular cylinder. When the material reaches the end of the cylinder, it falls through the connecting pipe into the cylinder below and passes through it in the opposite direction. The lower part of the hydrator serves as a cooler so that when the material has passed through the last cylinder it is ready for grinding. The hydrator discharges the hydrated lime directly into an Allis-Chalmers roller mill which grinds it to a powder and discharges it into the boot of a bucket elevator. This elevator carries the lime to the top of the building where it is discharged into a bin located over a 4-valve Bates valve packer. This packs the lime in 10-pound, 40-pound or 50-pound paper bags as desired. A 60 h. p. Imperial motor furnishes power through belt drives.

A storage warehouse 32x60 is provided for storage of the packed hydrated lime in case it is not convenient to load directly into cars or trucks for immediate shipment. Mr. E. C. Klieforth is superintendent of this plant.

The Oakfield Plant

Two lime kilns had been operated at Oakfield for many years until two years ago, when, while making a development for more limestone, a large deposit of shale was found. Investigation showed that this shale was present in large quantities and was suitable for making brick, tile and other burned-clay products. Everything was so favorable to successfully enter the clay products field and thereby enlarge their line of building products that it was deemed advisable to discontinue the manufacture of lime at Oakfield and erect an up-to-date clay products plant. The manufacture of drain and building tile was first attempted, with only one kiln and a short drying house. Later the drying house was increased to 100 feet in length, having 4 tracks throughout its length. Two additional kilns were added and the manufacture of building and face brick started.

A considerable area of the shale was stripped and the stripping used to construct a dam across the creek which flowed past the deposit. This dam impounds the water at an elevation sufficient to obtain a necessary pressure to operate the pug mill. The shale is mined by hand into side dump cars, which are hauled up a small incline into the top of the shale storage house by an electrically operated hoist, being side dumped onto the pile by hand. Gravity causes the cars to return to the pit when permitted to do so by the hoist operator. Power for the hoist is supplied by a 15 h. p. General Electric motor. A trench has been constructed under the storage pile and by removing sections of the cover to this trench, the shale falls into the trench as it is carried to the pulverizer by a 12-inch conveyor belt operating in the trench. This pulverizer, a Williams patent pulverizer, discharges the powdered material into the boot of a bucket elevator which elevates it to the top of the building where it is discharged onto a sloping screen. The fines from this screen pass into a hopper over the pug



The Shale Quarry at Oakfield

mill, while the coarser particles are chuted back into the Williams pulverizer for further reduction. The pulverizer, belt conveyor and bucket elevator are operated by an Imperial 60 h. p. motor.

The fine material is drawn from the bin into an E. M. Freese model KD pug mill, operated by a 75 h.p. Western Electric motor, where it is mixed with water to the proper consistency and forced out through the mold onto a belt that carries the molded product in a long string into the cutter. This, also an E. M. Freese model, cuts 17 bricks at a time. When tile are being turned out, a Bensings tile cutter replaces the brick cutter. The brick or tile pass along a belt until taken off by the operators and placed on triple deck cars for transportation to the dryer house. These cars are left in the dryer house and subjected to a slow heat until the green bricks or tile are properly dried, when they are pushed out of the opposite end of the dryer house and the bricks removed.

Opposite each of the three kilns a track turntable has been placed so that the cars may be switched into the kilns for loading with green brick, or the finished dried product transferred to the storage yard which is located at the end of the row of kilns.

Coal is used for firing the kilns and spur track from the Chicago and Northwestern Railroad near the plant allows the spotting of cars for the unloading of coal directly into the storage pile. Also rail shipments of the plant product are easily made direct from the storage piles. A fine quality face brick is being produced, which has created a good demand from the builders of Fond du Lac and nearby towns to which deliveries are being made chiefly by auto truck and trailer. Mr. Emil Dedhardt is superintendent of the Oakfield plant.

A Citizen Speaks Right Out

The editor of the Baltimore Evening Sun recently received an interesting letter from one of his readers concerning the conditions of the roads in his district. The letter was as follows,

Sir: We have had our roads repaired that have been neglected so long in this section of Carroll county, and it is a fearful and wonderful job. Rocks as large as your head scooped out from the side to the middle of the road; debris from the gutters piled up one to two feet high to run over unless you scatter it out as I did below my house where the men got tired. They skipped whole sections altogether , but I suppose it will suit the gang, as they had one of their number do the job. This section of Carroll county has been efficiently and systematically robbed of its share of road building for years. To make any permanent roads through this section there has never been any attempt. Crushed stone is unknown here. As for tarred roads, who puts tar on mud? The road building is done where the commissioners live, but from Carrollton to Asbestos mud roads are good enough. There is no attempt or provision made to get rid of water; where the road is in a hollow, the water stays for days for decorating purposes as you drive through the mud holes that are created.

Interior of Kiln at Oakfield. Note Track and Turntable Connecting With Yard Track

THE PHENOMENA OF THE SIOUX QUARTZITE

By Wiley B. Lowe

SIOUX Quartzite is named because of its prominent occurrence along the Big Sioux River and is the only quartzite of any commercial value in South Dakota. Much of the material is shipped in its various manufactured forms throughout the United States, but is restricted greatly by transportation cost to distant markets. The outcrop of this rock is scattered over a rudely triangular area. Geologists give its maximum width as sixty miles, extending across the northwestern corner of Iowa; it underlies about equal areas in South Dakota and Minnesota. The formation, although generally concealed by glacial debris and by scattered patches of Cretaceous rock, probably extends over a total area of more than 6000 square miles. Its age has been favored as the Huronian by many geologists who also state the lithological characters as almost identical with those of the Baraboo quartzite in Wisconsin.

The stone is composed of fine sand grains cemented firmly together by a siliceous cement created by water washing some deposit to form it, and its mixing with the water laid sand grains so that the rock will fracture as easily through the grains as through the cement. Apparently the rapid running of water over it formed ripple marks shown upon the false beds. Other phenomena are variation in degrees of dip of regular beds and their direction; the diversity of its many and unchangeable colors; the universal size of rounded quartz grains; the chimney upheavals of broken stone underlaid with clays, sands, pebbles and flints; the sandy open seams of various width running in different directions; the irregular formation of needle like shapes; the many checks in some strata evidently caused by heat as if doubtless metamorphosed into its present highly homogeneous condition by action of extraordinary heat. Some geologists have estimated the thickness of the deposit to be from 3000 to 4000 feet, while others place it at 1500 feet; hence it would appear that the thickness of the formation must of necessity be little more than a guess. A bore for an artesian well was made in this stone in Sioux Falls to the depth of nearly 1000 feet and finally abandoned with the loss of a diamond drill bit in the hole.

The quartzite presents many glaciated surfaces; edges that would otherwise be abrupt, are rounded; chatter marks are common. They are well described by Winchell who says: "It cannot be doubted that this marking was done by a force that exerted a great pressure at the same time that the marks were made. When the crushing resistance of the quartzite is computed, the pressure that caused these marks must have come from an ice sheet several miles in thickness. This pressure is evinced not only in the marking itself, but in the minute cross fractures that cover the surface where the rasping has taken place. These cross fractures run curvingly downward and at varying angles with the surface, and to all depths less than an inch, and indicate an incipient crushing to the depth of at least an inch."

The ice sheet or glacier coming from a northeasterly direction drifted and scattered in abundance boulders of granite and other stone of various sizes, shapes and formations over a comparatively large area east of the Missouri river and a short distance west of it. Many of the granite boulders are of beautiful colors and very durable, one of which has been found near Sioux Falls of large and unknown proportion transversed in part by the Big Sioux River, but otherwise covered entirely with debris. Many cords of fine building stone have been quarried and used from this black granite boulder. A similar boulder, but of quartzite stone approximately 40 feet by 50 feet and 12 feet above the surface in size, transported by glacier at least 75 miles was found near Cherokee, Iowa.

The quartzite is of a close grain and exceedingly hard, eliciting the most brilliant sparks from steel, and in most places where it is exposed to the sun and air its surface has a high polish entirely beyond any result which could have been produced by diluvial action, being perfectly glazed as by ignition. In a scale of density in accordance with which fluospar ranks at 4, geldspar at 5, glass at 6, agate at 7½, this stone ranks 7 2/10. In this connection the hardness of quartzite does not refer to the resistance to abrasion that the individual grains possess, but rather to the degree of adhesion between the individual grains.

The results of physical tests of road building rock —United States Department of Agriculture, Washington, D. C., show the crushing strength of the Sioux quartzite at 51,700 pounds per square inch, weight per cubic foot 165 pounds, absorption 27 pounds per cubic foot, per cent wear 1.4/10, French coefficient of wear 17.4/10, hardness 19.3/10 and toughness at 17. By comparing results of these tests with other material the quality of the rock is determined as to its suitability for various commercial purposes.

The following acid tests made on samples of Sioux quartzite show the rock to be very resistant to acid, and in each test made the appearance of the stone practically remained unchanged after passing the test:

Test No. 1

Nitric Acid—Boiled one hour in concentrated nitric acid then allowed to stand 18 hours in hot dilute nitric acid (one acid to one water) then washed with boiling distilled water till free from acid:

Weight of rock taken.....	4.8303	Grams.
" after treatment	4.8287	"
Loss in weight.....	0.0016	"

Test No. 2

Hydrochloric Acid—Same treatment as Test No. 1—except hydrochloric acid used.

Weight of rock taken.....	4.3440	Grams.
" after treatment	4.3430	"
Loss in weight.....	0.0010	"

Test No. 3

Sulphuric Acid—Same treatment as Test No. 1—except sulphuric acid used.

Weight of rock taken.....	3.8272	Grams.
" after treatment	3.8267	"
Loss in weight.....	0.0005	"

Summary

Loss at 105 deg. C.....	0.01
Loss on ignition.....	.23
Silica as S10/2.....	98.85
Iron Aluminum—Calc. as FE/203 and AI/203 Calcium-Trace. Magnesium-Trace	1.02
Total	100.10

Some defects in state of aggregation exist to a more or less extent in some localities where sand pockets are found in the beds of quartzite, where certain geologic conditions have not favored the process of uniform cementation in which the grains are more poorly cemented than the surrounding material in different parts of the same bed and will crumble away. This inferior stone is, therefore, classed as waste as it is useless for structural, paving or like purposes, and is to be avoided when used as aggregate in connection with concrete cement road pavements as the soft units of the cubes or angular fragments will crumble and break out by traffic thus causing a pitted surface on the pavement injurious to its life.

The quartzite when crushed breaks in to irregular angular fragments and splinters; and like all extremely friable rock the cementing value is low. This lack of cementing value, however, is greatly overcome when used wet in mixed sizes or as commonly termed crusher run size of the product, thus filling voids. Good durable service for road purposes under heavy traffic have obtained when it is used as an aggregate in connection with bitumen and similar types of road construction.

The fusion point is very high, approximately 3,300 degrees C., consequently it is a refractory of superior quality. Possibly the original coal-oil of the stone itself, whence is supposed to have come its delicate color, ignited to give its present insensibility to heat.

Quarry equipment and necessary tool appliances are much the same as used in all hard stone quarries, excepting, however, tool steel, which requires a particular make and grade as well as great skill in tempering owing to the extreme hardness of the stone. In the blasting of the stone, owing to its friable nature, great care is required to avoid shattering resulting in considerable waste of good stone, especially when the stock is to be carried for dimension stock. On the other hand, when quarried for crushing, the opposite obtains, but in either event great skill and efficiency is or should be required to obtain the desired results.

Commercial Exploitation

The common uses of this rock are for public buildings, due to its durability and attractiveness. Dirt will not stick to it. Street paving blocks. Rubble, dimension, rip rap and river revetment stone—it will not disintegrate in water. Ferro-Silicon. Ganister. Furnace converter linings for steel mills. Liners and grinding pebbles for use in tube mill grinding of ores and production of metals. Digester saucers and linings for acid tanks. Crushed for sewage disposal plants, and as aggregate for concrete material used in the building of structures, roads and streets. Stucco facings.

Ferro-Silicon

It was during the year 1918 that this stone for ferro-silicon was first introduced and used by a firm of manufacturers located at Keokuk, Iowa. The silica deposit near their plant from which they expected to procure quartz rock suitable for their purposes did not prove very satisfactory at the time, and their attention was called to the Sioux quartzite. Samples suitable for their experimental use were sent them, which were reported upon favorably resulting in the placing of large orders for the stone in spite of the high transportation charges, approximately $100.00 per car load.

In this connection the manufacturers were prevailed upon to move their plant near the source of supply of raw material, saving freight on the stone, but owing to the high cost of electric current obtainable per kilowatt year of power required for electric furnaces necessitating a high load factor. No offer in comparison with the elements of cost as an argument for the location of a ferro-silicon plant in this or any other locality unfavorable to cheap current could be made, such as is obtainable at Keokuk by reason of the location of the hydro-

electric water power dam crossing the Mississippi river at that point.

There are relatively few manufacturers of ferro-alloys in the West; some of them within reasonable distance of the Sioux quartzite are Keokuk, Iowa, Chattanooga, Tennessee, Niagara Falls, New York, and Shawinigan Falls, Quebec. Hence it is manifest that cheap electric current is a potent and fundamental factor in the manufacture of ferro-alloys; and while silica or quartzite rock is found in a great variety of form, widely distributed, if its physical properties are not of the right form, it is useless for this and many other purposes.

Fused Silica Products

There are many uses quartzite may be applicable for when fused as in the manufacture of electro-quartz laboratory crucibles, wedgewood pottery and wares, various silica products made from quartz rock. No attempt to any great extent appears to have ever been made in the United States to manufacture for market these products, largely imported from European factories into this country in which abound silica quartz deposits in abundance, suitable for the processes of manufacture sufficient to establish similar industries. It, therefore, seems apparent that this is a matter for our commercial exploitation. There are many technical difficulties, however, attending its process of manufacture covered and protected by European patents. Its process of production by Europeans is, therefore, a strict trade secret which, it is said, their workmen employed in the factories are not permitted to know about or to work on the entire process of production.

Street Paving Blocks

The manufacture of this stone into cubed and small sized modern improved street paving blocks, having the smoothness of vitrified brick, giving universal satisfaction, was introduced some years ago in paving of streets in Chicago, Illinois, St. Louis, Missouri, Kansas City, Missouri, Des Moines, Iowa, New Orleans, Louisiana and many other cities. The workmen employed are practically all of foreign nativity. The trade of cutting blocks being a distinct trade of itself, the World war caused a disorganization, due to inactivity of the cutters. Therefore, lack of apprentices resulted in a consequent scarcity of both, and in addition to this the late immigration laws; the increased freight rates to distant markets and poor local demand proved detrimental to the industry. The process of block manufacture from this stone, sizes and styles of blocks as well as street construction, may more properly be covered under separate caption.

Building Stone

Owing to the extraordinary hardness of this stone, carved and extensive tool cutting work should be avoided and eliminated as much as possible in order to reduce the cost of its preparedness. The deeper the stronger effect is obtained in bold rock face work, confining the various tinted colors of pink, purple and violet as chosen to a uniformity of the different shades. Plans should be prepared adaptable to stone dimensions procurable from quarry stock rather than the opposite, which every practical architect will recognize. Many handsome structures have been constructed from this stone within its trade territory and to fairly remote points that are everlasting monuments of its strength and beauty.

1927 Sand and Gravel Convention Goes to Cincinnati

The executive committee of the National Sand and Gravel Association, at a meeting in Detroit, Michigan, on June 29th, decided to hold the next annual convention of the association at the Gibson Hotel, Cincinnati, on January 17, 18 and 19. The Gibson Hotel is large enough to house the entire attendance and any of the three or four convention rooms are excelelnt for holding the different sessions of the Sand ad Gravel Association. Stanton Walker, Chief of the Research Division of the National Sand and Gravel Association presented a report at this same executive meeting. Mr. V. P. Ahern was appointed Executive Secretary of the National Association, and presented his report which showed the Association to be in excellent financial condition.

The following were in attendance at these meetings:

E. W. Dienhart, Acme Concrete Products and Gravel Co., Cement City, Mich.; H. H. Halliday, H. H. Halliday Sand Co., Cairo, Ill.; Stanton Walker, National Sand and Gravel Association, Washington, D. C.; V. P. Ahern, National Sand and Gravel Association, Washington, D. C.; O. E. Gooding, Standard Gravel Co., Pontiac, Mich.; J. J. Haarer, Ray Sand and Gravel Co., Detroit, Mich.; H. H. Battjes, Grand Rapids Gravel Co., Grand Rapids, Mich.; W. F. Fisher, Tecumseh Gravel Co., Tecumseh, Mich.; J. M. Settle, Ohio River Sand Co., Louisville, Ky.; J. E. Carroll, J. E. Carroll Sand Co., Buffalo, N. Y.; E. H. Perry, Lenawee Sand and Gravel Co., Tecumseh, Mich.; L. J. Dyament, Ward Sand and Gravel Co., Oxford, Mich.; L. K. Lendon, United Fuel & Supply Co., Detroit, Mich.; H. C. Ellis, Ohio and Michigan Sand and Gravel Co., Toledo, Ohio; Hugh Haddow, Jr., Menantico Sand and Gravel Co., Millville, N. J.; H. S. Earle, president, Genesee Gravel Co., Detroit, Mich.; R. C. Fletcher, Flint Crushed Gravel Co.; Des Moines, Iowa; J. L. Shiely, J. L. Shiely Co., St. Paul, Minn.; Earl Zimmerman, Ohio Gravel Ballast Co., Cincinnat, Ohio.

REBUILDS TO DECREASE COST OF PRODUCTION

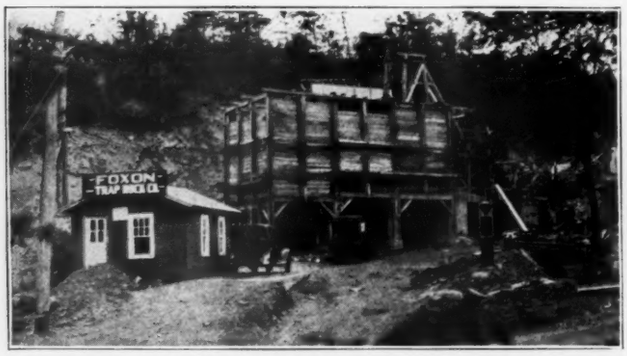
By George Ransom

NEW HAVEN is located on Long Island Sound, in the southern part of Connecticut, 75 miles north of New York City, which can be reached in two hours by rail and three and one half hours by auto or bus. New Haven is the county seat of New Haven County. As the home of Yale University, New Haven occupies an important position in the educational world. The standard of living is high and there is a preponderance of one and two family houses, with much residential development in progress. Construction of better grade apartment houses is on the increase. The trading area of New Haven extends about 22 miles north, 11 miles west and 26 miles east. The heavy tourist automobile travel in and around New Haven makes it essential that there be ample highways and that they be kept in good condition. In fact, the demand for crushed stone has developed so rapidly that contractors have considered operating their own crushed stone plants.

The D. V. Frione and Company of New Haven, which has several state contracts in hand and also important work for the city of New Haven, has recently entered the crushed stone business as a result of these conditions. During the last couple of years they have had much trouble in obtaining crushed stone from the large producers in the vicinity when they wanted it, which has resulted in embarrassment and financial loss. To overcome this difficulty the company, late in the summer of 1925, purchased the Foxon Trap Rock Company, which was a small operation within the city limits of New Haven located in the Fair Haven district. This was a new quarry, but had only been operated in a small way. The plant was operated as it stood for the remainder of the summer, but in the spring of 1926 the crushing plant was entirely rebuilt and re-equipped so as to materially increase its capacity and decrease the cost of production. The present layout is designed to produce 300 tons per day; and any surplus which may result from this can easily be disposed of to local users.

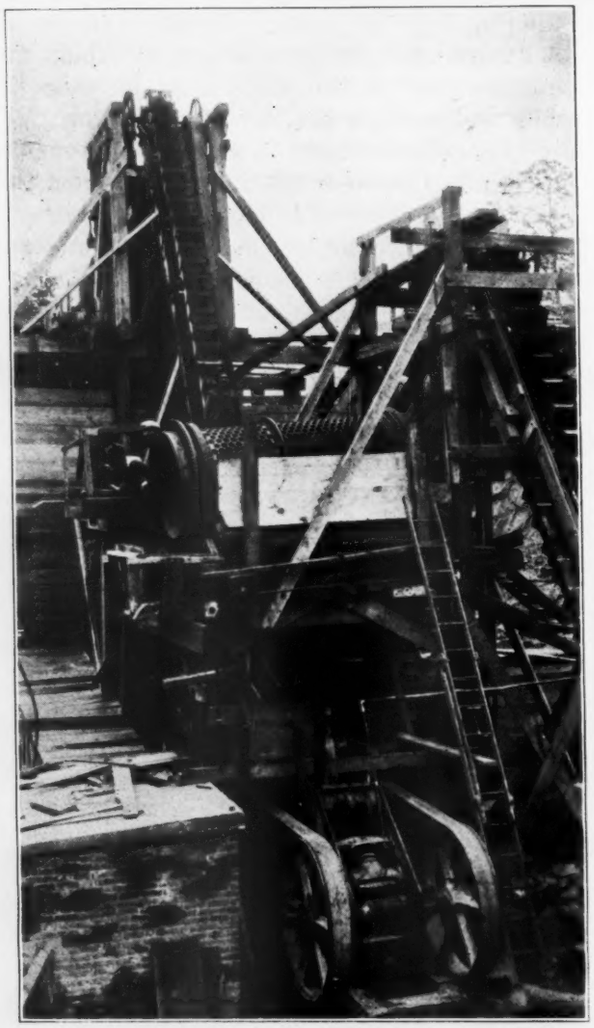
The quarry is located on an automobile highway and shipment will be made entirely by motor trucks which will be mostly those owned by D. V. Frione and Company and to a lesser extent those belonging to others who purchase the material. Most of the trucks owned by D. V. Frione and Company are Mack trucks provided with Wood hydraulic hoists. The purposes for which this plant will be used, that is, to produce crushed stone for the use of contractors doing work in the vicinity, render motor truck transportation obviously preferable to railroad transportation.

Steam Shovel in Quarry



General View of Crushing Plant and Office

Detail Showing Method of Attaching Service Wires to Sides of Bins

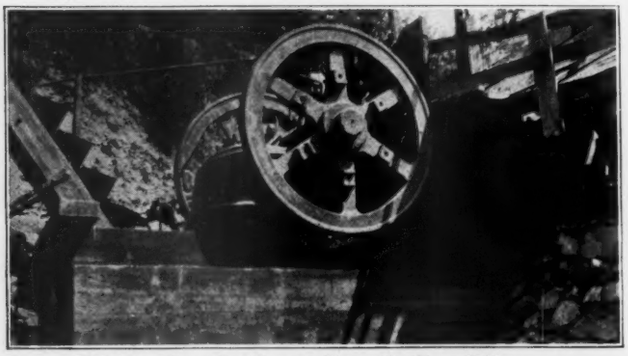


View of Secondary Jaw Crusher Scalping Screen and Elevators

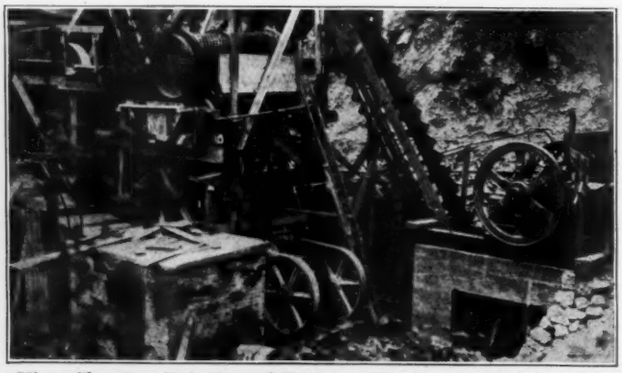
The quarry is on a ridge of land above the highway with the crushing plant below. The drilling equipment consists of a Keystone steam drill and two Ingersoll-Rand jackhammers for breaking up large pieces. At first the compressed air for the jackhammer was supplied by means of a portable gasoline engine driven air compressor made by the Domestic Engine and Pump Company. This outfit is used in the general contracting work of the owners and was temporarily drawn into this service until the permanently installed compressor was completed, which is an 8x9 Ingersoll-Rand machine, driven by a Westinghouse induction motor and control apparatus.

A Marion steam shovel, equipped with crawlers, is used for loading in the quarry. The primary crusher is fed from the same level as the floor of the quarry and is only a short distance away. At first the stone will be carried to it by motor trucks equipped with dumps, but it is expected that by next spring these trucks will be replaced by quarry dump cars operating on tracks. It is felt preferable to develop the quarry somewhat more before deciding definitely on the final arrangements of the conveying medium.

The primary crusher is a Farrell of the jaw type, 18x36 inches in size. This discharges into a Good Roads Machinery Company elevator which deposits the stone into a scalping screen. The throughs are of mixed commercial sizes and are dropped into another elevator which carries them to the sizing screens. All of this equipment being of Good



Primary Jaw Crusher on Concrete Foundation



View Showing Relation of Primary Crusher to Scalping Screen and Secondary Crusher

Roads Machinery Company manufacture. The overs from the scalping screen drop to an 18x26 inch Champion jaw crusher which discharges to the elevator carrying the screenings from the scalping screen to the sizing screens, from which the various sizes fall into bins. The illustrations show the relative arrangement of the primary crusher with the conveyor to the secondary crusher and scalping screen.

This crushing plant is driven by a 60 h.p. Wagner Electric Company induction motor. The safety disconnect switch for this motor was supplied by the Trumbull Electric Manufacturing Company of Plainville, Connecticut, and the starting switch by the Cutler-Hammer Company. A United States Rubber Company "Rainbow" belt is used for the motor drive. There is also a push button control station at the feed level of the primary crusher so that the machinery may be stopped from this point in case of emergency.

The electrical service connection from the highway distribution line consists of three 800,000 circ. mil rubber insulated and braided cables made by the Simplex Wire and Cable Company. They are supported along the sides of the bins as shown in one of the illustrations.

As will be seen from the illustration, the stone storage bins are so arranged that motor trucks may be loaded from under them, and the company owns adjacent property which will be used for the storage of surplus material. A shop where drills may be sharpened and other repairs made is a part of the establishment. This consists of a forge provided with a "Royal Western Chief" rotary blower, a C. Parker Company vise, an R. H. Brown and Company drill and chuck and an oxy-acetylene outfit consisting of Linde Air Products and Prest-o-lite tanks. The office is a neat building near the end of the stone bins. Scales, made by the New Haven Scale Works, for weighing the trucks, are located just outside of this building with the measuring beam inside the office.

Naples Needs Calcium Arsenate

The Director of the Cattedra Ambulante di Agricoltura (Travelling Agricultural Bureau) for the Province of Naples advises that calcium arsenate is used to some extent but that lead arsenate, much of which is imported from the United States and is considered of excellent quality, is in general use. Dealers in insecticides are of the opinion that calcium arsenate can be introduced successfully into this district if its price be sufficiently low to be attractive and if it proves efficacious in combating disease and pests.

The most prevalent diseases and pests are those which affect the fruit, nut and olive trees, and tomato and grape vines. The principal diseases are the floxera and the pernospera nigrescens; the insect pests generally found are the mosca olivetta, icerya purchasi, tingis puri, dactylopius vitis, dactylopius iceria and various coccidas. Other pests appear occasionally, such as the scarabeo nebulosis, which last spring ravished the apricot trees. The damage done to crops by these parasites is frequently enormous. The 1925 olive crop was virtually ruined by them. The chief insecticides now used in this district are sulphur compounds, tobacco extract, soap, kerosene, Bordeaux mixture, lead arsenate, and calcium arsenate.

The South Italian farmer is alive to the necessity for using insecticides and germicides to insure his crops but, in the main, he is too poor and uneducated to experiment in their use. For his assistance, the government maintains agricultural stations in the various regions of the country which carry on experiments and assist the farmer in all ways possible to them by disseminating the results of their investigations. These stations carry supplies which they frequently sell to the farmers, at reduced prices. In this manner, the farmer utilizes proved methods and materials and he suffers no loss. In consequence, the government farming agencies are the centers of activity and their suggestions and opinions are followed by the people. It would not seem possible to introduce large quantities of calcium arsenate into this district until it should have been used experimentally and proved efficacious but ever greater efforts will be made to increase and to improve crops, and effective insecticides will be in increased demand.

The best method of introducing this product commercially would be through a general agent located in one of the main distributing centers, such as Milan. He should be empowered to appoint sub-agents in the south of Italy. Demand for the product could be stimulated by interesting the various regional farm cooperative associations, which are often cooperative purchasing agencies, or more effectively through the Cattedra Ambulante di Agricoltura, which could influence the farmers by their suggestions, and might even act as a distributing agent to him.

German and Italian insecticdes now enjoy the greatest market, the German product being the most popular. The importation into Italy of arsenates and other arsenic compounds has increased from two tons valued at approximately $650, in 1923, to 85 tons valued at approximately $14,000, in 1925.

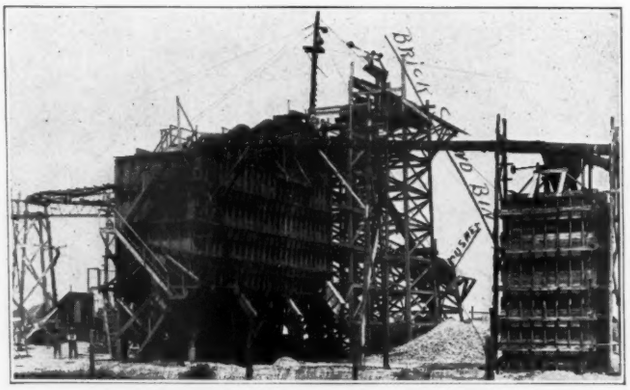
Canada Portland Opens Hull Plant

The Canada Portland Cement Company with headquarters in Montreal, which operates several plants in Canada, has reopened its Hull plant. This plant has been shout down for many years.

BEAM'S METHOD OF WASHING AND SCREENING

AMOS BEAN, superintendent, Grant County Sand and Gravel Company at Marion, Indiana, has just installed a system of washing and screening somewhat different from the usual method. A year ago this company installed a washing plant with a conveyor system. This conveyor, 170-foot centers, was set at an angle of about 20 degrees. At the foot of the conveyor was a 2-inch scalping screen and a 9x24 inch crusher. The material was excavated with a Sauerman cableway excavator and discharged to a tipple 25 feet high. The material was then chuted to the scalping screen and everything over 2 inches went to the crusher. Everything from the crusher and scalping screen dropped onto a conveyor belt at a height of 52 feet. The screening plant consisted of a scrubber and two screens and had an estimated capacity of 750 tons per ten-hour day.

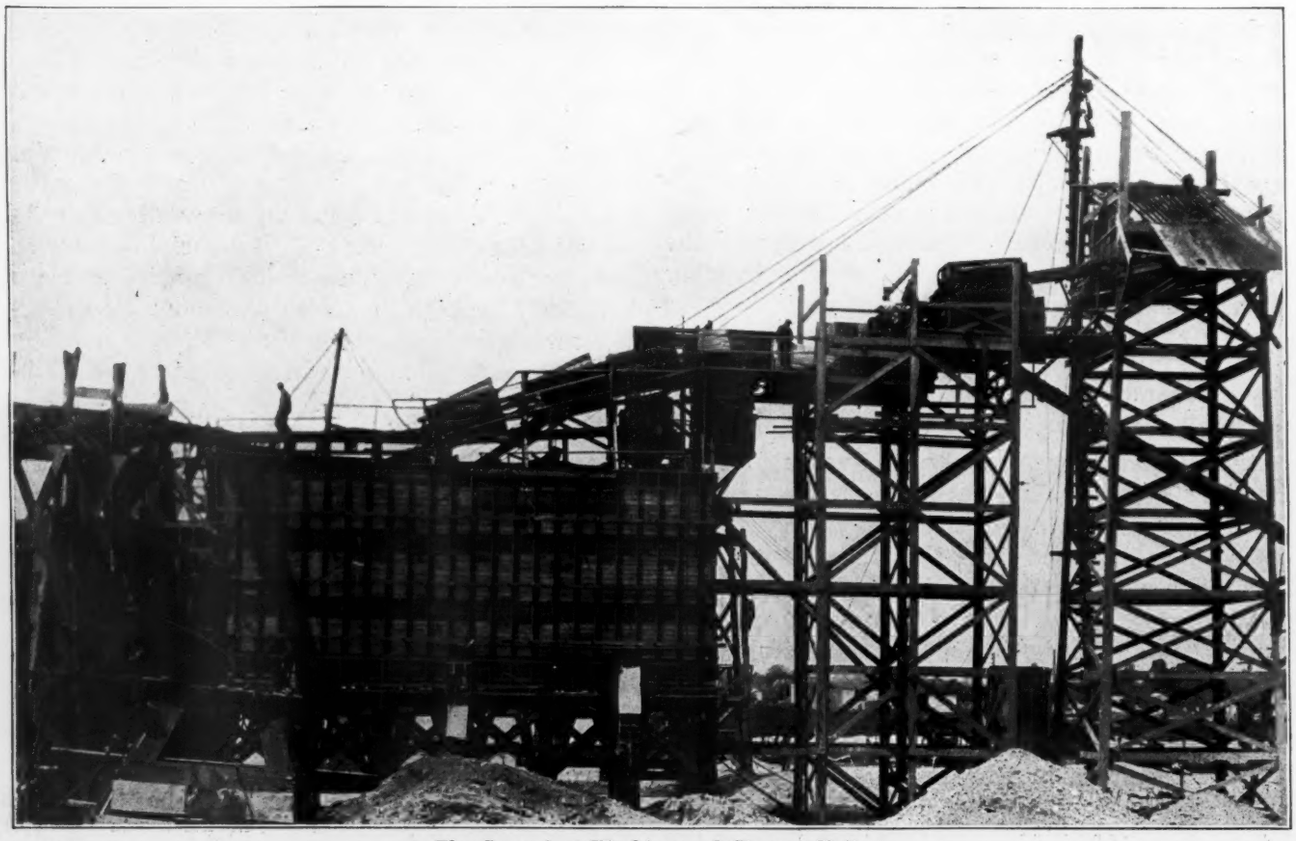
It was not possible, however, to reach anywhere near this capacity. The pit was wet, and even though the material was dewatered to a certain extent before it reached the belt, a great deal of trouble was experienced in getting the material to ride the belt. At a depth of about 30 feet in the pit, a clayey substance was encountered which refused to stay on the belt. It was about the hardest material to wash and screen properly. A pump with a capacity of 1,000 gallons per minute and a



The Brick Sand Bin at the Right

35-pound pressure at 50 feet supplied the water for washing. Spray pipes were carried at the end of the screens and in the loading chutes. As long as the gravel was wet it looked clean, but when it became dry a film of mud coated it to such an extent that it would not pass inspection. Even when some of the material would ride the belt, a very poor separation resulted and sometimes as much as 20 per cent of the sand would remain in the gravel. The screen perforations were kept open and they were 72 inches long with 48 inches at the large end and 24 inches at the small end.

For some years Mr. Bean had in mind a system of washing and screening gravel which he thought



The Screening, Washing and Storage Units

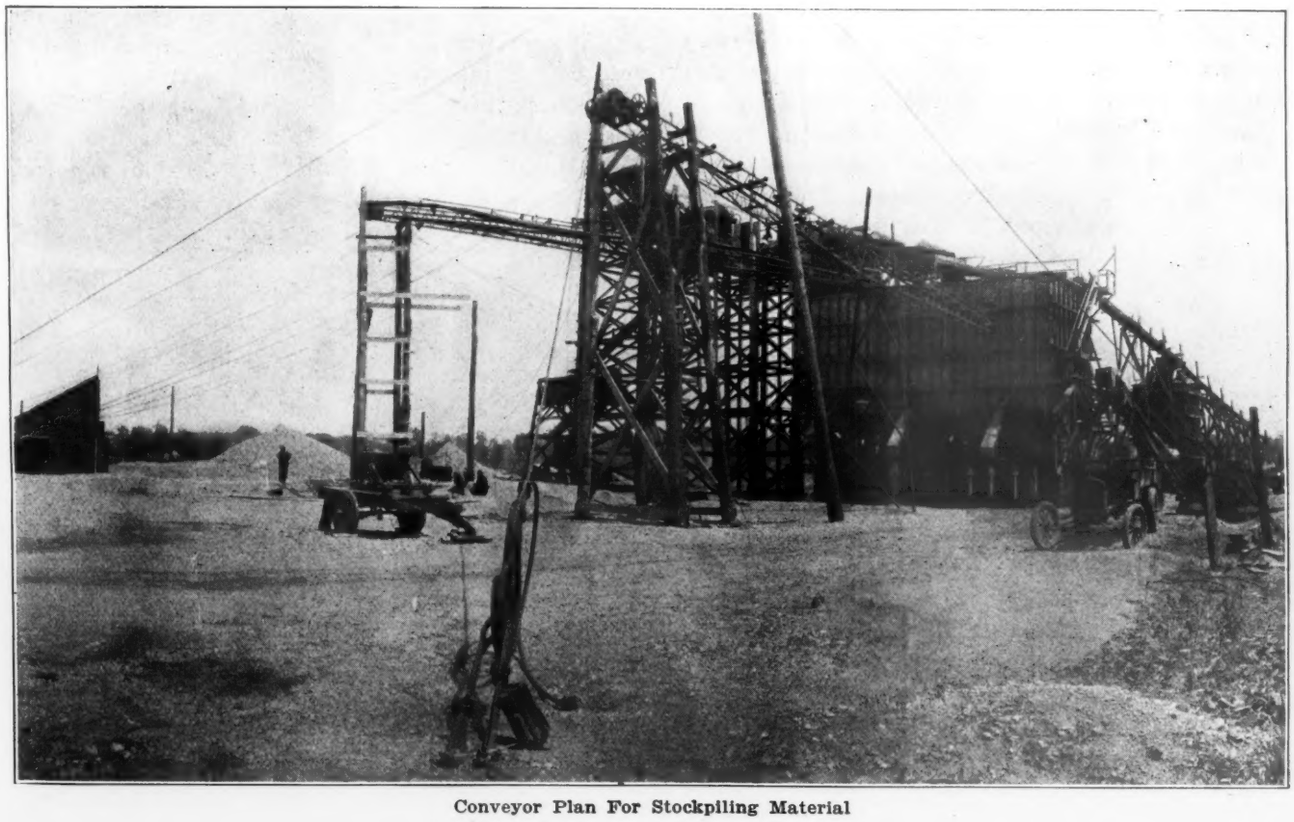
would make a good separation and a good washed material. Last fall he drew a set of plans and submitted them to the company for its approval. After due consideration, Mr. Warner, the president, ordered him to put into operation the following system:

First, Mr. Bean took the conveyor belt down and installed it on the top of the bins, under the screens which were then used to stock pile two different grades of gravel at a height of 40 feet. He did not lose anything by making that change. Next, he built a tipple 60 feet high, with grizzly bars spaced 4 inches apart. He is just now installing a feeder, although the plant has been in operation for about two months on this system. Leaving the feeder the gravel passes through a short flume to a 2-inch scalping screen. Everything over 2 inches goes to the crusher at the bottom of the tipple, where it is crushed and chuted to the pit. When needed it is returned to the top of the tipple with the bucket.

All the material passing through the 2-inch screen goes to a 3-16 inch square Leahy vibrating screen. Right under the vibrating screen is a settling tank, where from 85 to 90 per cent of the sand is separated out of the gravel to start with. Right here is where all of the dirty water stops and overflows back to the pit. The usual method is to allow the dirty water to pass all the way through the full operation of the washing and screening and then on to the waste sand pile, just where it should not be, for if the sand should need to be reclaimed, it would be necessary after the dirty water had passed over it to take it through the washing system again. Last winter and early spring, while the plant was closed down for rebuilding, the small amount of sand sorted in the bins was soon exhausted. Several hundred tons of washed sand could have been sold after the bins were empty, and several thousand tons of dirty sand were on the waste sand pile that could have been clean sand if the dirty water had only been stopped before it got to the sand pile.

Under the new arrangement the following method is used. The sand is passed over two settling tanks, one of them being under the vibrating screen. The dirty water from the sand and gravel overflows over the tank and back to the pit. Another settling tank is located in the sand bin. The sand is flumed from the first tank through a pipe with clean water to the second tank, or the tank that is in the sand bin. Tank number 1 is the one that is placed between the tipple and sand bin, and tank number 2 is in the sand bin. Clean sand is washed from tank number 1 with clean water to tank number 2. After tank number 2 has filled the sand bin, the sand is overflowed with clean water to the waste sand pile, which is called the sand stock pile, instead of waste sand pile.

Five 2-inch spray pipes furnish water on the vibrating screen. The upper three pipes help to drive the fines through the screen, and the two lower pipes wash the gravel as it leaves the screen. This is the first washing on the gravel and this water goes to the tank also. The gravel is dis-



Conveyor Plan For Stockpiling Material

charged from the vibrating screen onto a conveyor belt of 10-foot centers. This belt acts as a mud-picking table. Two men are stationed at this belt part of the time to pick mud, for it is a clay that is as tough as iron. It cannot be beaten up and washed out as is the case with some mud. The gravel, on leaving the belt, enters a flume and gets its second bath of clean water by being washed onto the scrubber. Now the washing process starts all over again. The scrubber churns it around and then discharges it into a 3-4 conical type rotary screen. In the end of this screen are spray pipes that wash the gravel again on leaving the screen. Everything under 3-4 inch is carried onto the next screen which is 1-4 inch, and the same process of washing is repeated. A double separation is effected by passing the material over two sets of small screens. The first screen is a 3-6 square mesh vibrating screen, set near the head of the screen system, and the other is a 1-4 inch round rotary screen, set at the foot of the screening plant. There is always a small per cent of sand carried over the first small screen with the gravel, but there is such a small per cent of sand left that the last screen has no trouble at all of passing all of the sand through, leaving the gravel clear of sand.

Grading tests at the plant, taken by a state highway engineer, show less than 1-2 of one per cent of sand left in the gravel. Sometimes, material will run from the pit as high as 70 per cent sand.

The plant is equipped with a Sauerman two-speed, 75 h. p., electric hoist, one of the latest type, and a Pioneer one cubic yard bucket, operating over a 500-foot span. Sauerman roller bearing blocks are on the mast. A Dean Hill pump with a capacity of 1,000 gallons per minute is driven by a Fairbanks-Morse, 75 h. p., roller bearing motor. A 9 by 24 inch Cedar Rapids jaw crusher is driven by a 40 h. p. Fairbanks Morse motor. There is also installed in this plant a Telsmith recipitation feeder. Dull rotary screens and scrubber, and two Telsmith automatic settling tanks. One 3 by 6 foot Leahy vibrating screen and a 2-inch revolving scalper screen are used.

June Construction Shows Decrease

The volume of building and engineering contracts declined very slightly in June, according to F. W. Dodge Corporation. Construction contracts let during the month in the 37 states east of the Rocky Mountains (which include about 91 per cent of the total construction volume of the country) amounted to $547,792,400. The decrease from May 1926 was less than 1 per cent and the decline from June of last year was 2 per cent. The very good showing for June of this year was to a considerable extent due to increased activity in the Pittsburgh district, which had last month its highest total so far this year.

The more important classes in last month's building record were: $237,724,900, or 43 per cent of all construction, for residential building; $98,200,200, or 18 per cent, for public works and utilities; $67,960,200, or 12 per cent, for commercial buildings; $54,514,700, or 10 per cent, for industrial buildings; $40,753,400, or 7 per cent, for educational buildings; and $17,036,600, or 3 per cent, for social and recreational projects.

New construction started in the 37 eastern states during the first half of 1926 reached a total of $3,113,158,500, as compared with $2,748,694,800 in the corresponding period of 1925, the increase being 13 per cent. The figure for the first six months of this year was also the highest on record for the first six months of any year. Contemplated building and engineering work for the 37 eastern states was reported in June 1926 to the amount of $807,281,800, being 2 per cent above the amount reported in May of this year, as well as 16 per cent above the amount reported in June 1925.

General View Showing Waste Flume and Brick Sand Plant at Left

KUSTER AND WATERBURY HAVE PLANT DESIGNED FOR LOWER LABOR COST

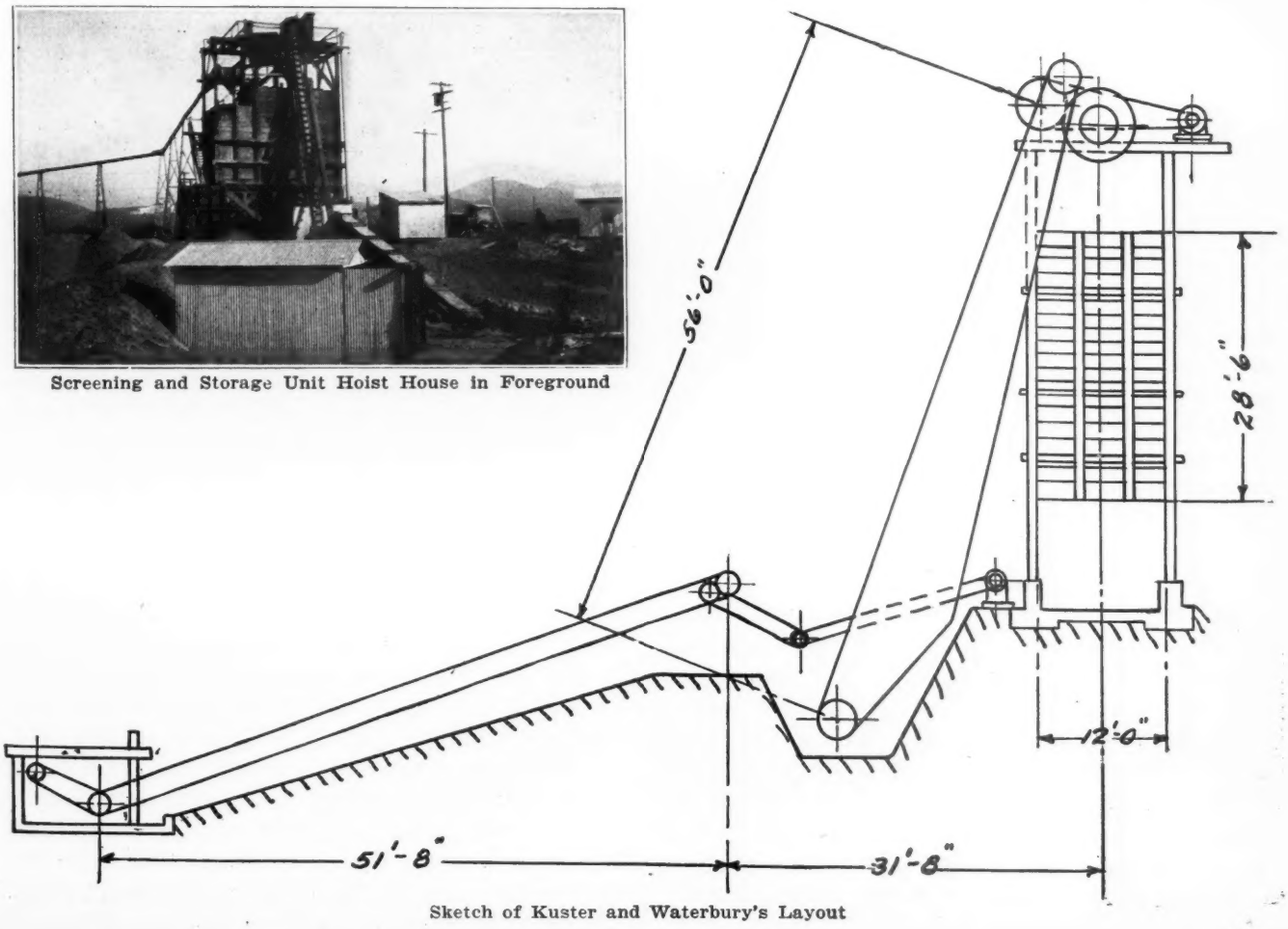
KUSTER and Waterbury's sand and gravel plant at Corona, California, was designed to meet the needs of a small community of moderate growth. The principals were aware that they could not meet the competition of the up to date plants in the locality unless they made a modern installation and delegated to machinery work which is frequently done by hand.

Every investment was made with the idea of permanence and economical handling. So successful has been their plan to do away with man power that they are operating a plant with a capacity of 250 yards of screened and graded product, they say, with one man except when rush delivery is required.

The plant is located in a valley which was filled with sand and rocks by a prehistoric stream. When there is excessive rain fall in the hills the valley still floods and the plant had to be carefully placed to avoid destruction by water tearing down the valley. With all the care taken, shortly after the operation started last summer a cloudburst did considerable damage and delayed the getting

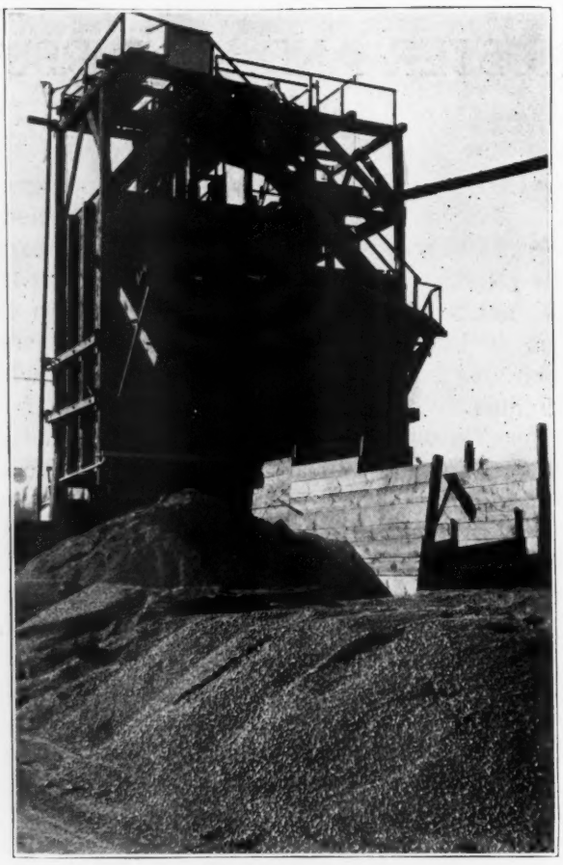
The Trucks Load Under Bins

Screening and Storage Unit Hoist House in Foreground



Sketch of Kuster and Waterbury's Layout

Path of the Dragline



Outside Storage

under full headway. The damage was soon repaired however and the plant functioning normally.

The plant was designed by the Stephens-Adamson Company with the idea of preparing those grades of material needed by every community and machinery was sold by the Brown-Bevis Company of Los Angeles. The deposit is excavated by a drag line and hoists. The material is dragged up from a considerable depth toward the hoist house where it is dumped into the hopper of a Stephens-Adamson plate feeder and then onto a belt conveyor made by the same company.

The belt conveyor has 4x8 inch stringers on 25 inch centers. This belt conveyor elevates the material 13½ feet and discharges onto a bar grizzly set at an angle of 45 degrees.

The material passing over the grizzly falls into the jaws of a 2M Universal crusher. That which passes through goes under the crusher and there meets the reduced material and with it is lifted by a Stephens-Adamson bucket elevator working on 56 foot centers with 10x6 inch buckets on 16 inch centers to the washing and screening plant. This is a Stephens-Adamson "Gilbert" screen with a jacket having a two size sand screen. This separates the concrete and plaster sand. The inner skirt of the screen is extended beyond the jacket and acts as a scalper. The tailings are chuted back to the crusher and go through the same conveying process again, returning to screen with new material.

The fine sand and water are chuted to a No. 5 Telsmith settling tank which discharges into one of the three storage bins. The other storage bins receive the gravel directly from the rotary screen.

One of the noteworthy things about this plant is the neatness of its appearance; the hoist house and sheds are all of corrugated metal and are kept clean and painted. The plant is electrically operated on purchased power. The screen and bucket elevator, are run by a 7½ h.p. motor and the crusher and feeder by a 15 h.p. motor.

The plant will soon have rail connections and this probably will call for additional installations. At present however all material is hauled away by means of Ford trucks.

Universal Advances Moore

O. L. Moore, formerly engineer, Inspection Bureau, Universal Portland Cement Company, has been appointed to the position of Engineer of Tests in that company, according to an announcement from the Chicago office of the Universal company. Mr. Moore is a graduate of Carnegie Institute of Technology and a member of the American Society For Testing Materials, American Concrete Institute and Western Society of Engineers. He has been connected with the Universal Portland Cement Company for the last twelve years.

SIMPLICITY IN DESIGN REDUCES COSTS

THE Multiplex Cement Block Company, Mt. Clemens, Michigan, operates a small gravel plant which has a capacity of 300 yards in 10 hours and is worked by two men, one man attending to the hoist and the other loading trucks and doing odd jobs as required. This company also manufactures concrete products such as building blocks, drain tile, building tile, window sills, bin tiles, etc., from surplus sand which has not been sold through the regular channels.

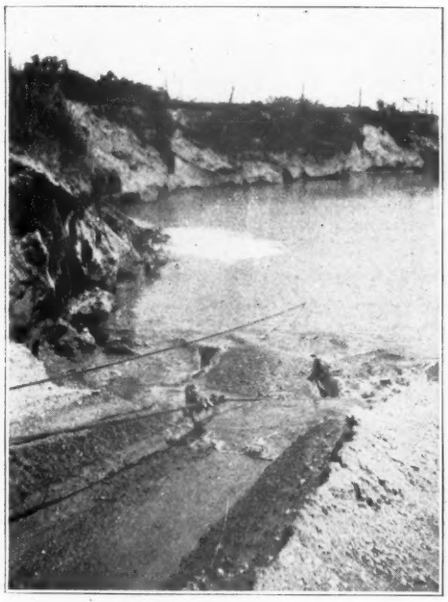
This plant is owned and operated by O. R. Lundquist and O. W. Lundquist. It was primarily built to take care of retail trade within trucking distance of the pit, which is the closest of any to the city of Detroit, Michigan, being located only six miles from the city limits, in the midst of a rapidly growing suburban community along Lake St. Clair.

The gravel deposit is of glacial origin, and the entire deposit covers less than 150 acres, this plant being designed to work six of them. The gravel extends below the surface of the surrounding country to a depth of 80 feet, of which about 70 feet must be removed from under water. The gravel is uniform, and stones over 4 inches are seldom encountered. The overburden varies from a few inches to three feet in depth. This is removed by means of a Fordson tractor and Fresno scraper, which is operated by the pit crew at such times as the weather will not permit the delivery of the output of the plant.

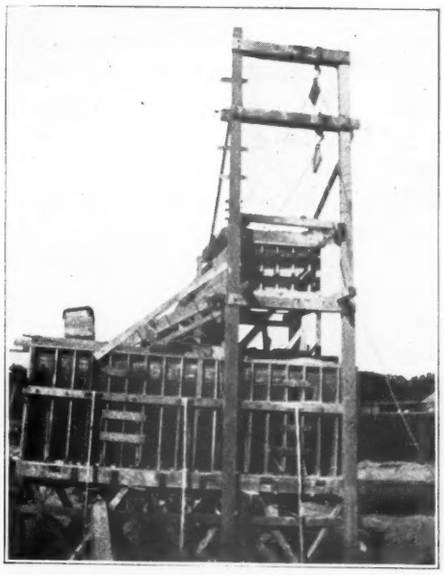
The excavating and conveying of the gravel has been designed to make the operation and upkeep as low as possible. That this has been accomplished is shown by the fact that in eight weeks of operation the average cost has been only 13 cents per yard of sand and gravel f. o. b. trucks at the pit. This cost includes labor, motor, fuel, lubrication, 25 per cent per year depreciation and the electric current consumed.

The plant consists of bins, hoisting machinery, drag line scraper, washing tank and a concrete products plant, the latter operating to use up the surplus of sand present in the gravel. The bin structure is divided into three compartments (another is being added) of 12 yards capacity each. One contains pit run gravel, one sharp sand screened through 1-4 inch mesh, and the third gravel which does not pass through the screen. The fourth bin is to be used for plaster sand passing through a 1-12 inch mesh screen. The material is excavated and conveyed to a grizzly by means of a Weller 3-4 yard bucket and a Novo hoist.

The hoist is a special heavy duty drag line type and is driven by means of a 40 h. p. General Electric motor. The material is dragged up an incline to a height of 26 feet where it passes into a small hopper. Here part of the material is deflected to



Bucket Coming Out of Water



Hopper and Chute for Deflecting Material

Incline to Screening Plant

the screen by means of a baffle and chute, and part is passed directly to the pit run bin. The amount of material deflected to the bin can be varied by means of slides.

The screen is of a vibrating type and is driven by means of an electric motor. The gravel deposit is exceptionally clean, so the washing is a simple matter. A 1 1-2 inch stream from a Union centrifugal is washed through the gravel on the screen and is flushed off in the tilting tank, the pump being driven by a 5 h. p. electric motor.

All electric motors are General Electric, 220 volt, 3 phase, induction type. The cable used is American "Tru Lay." The successful operation of this plant is entirely due to the simplicity of design and to the fact that only the best material and equipment was used in its construction. No makeshift expedient was allowed to enter into it, but parts with a surplus of strength were used at every point where these were subject to undue strains or wear. The entire incline is covered with 3-16 inch thick sheet steel, four feet wide, bolted solidly to the wood structure.

The material is delivered direct to the job by trucks, these being hired at the rate of 15 cents per yard per mile. For the manufacture of the concrete products a Multiplex block and chimney block machine, a Miles block machine and a "Duntile" tile machine are employed, about twenty yards of material daily being used for this purpose.

PRODUCE SIX TONS OF TRAP ROCK PER POUND OF EXPLOSIVE

"QUARRYING Texas Trap Rock" is the title of an article by R. H. Summer in the last number of the Du Pont Magazine. The result of a well planned blast was the real subject of the article and we present the details of this blast here for the benefit of our readers who have not read the article by R. H. Summer.

The Texas Trap Rock Corporation is quarrying from a large deposit of high-quality stone at Knippa, Texas, and marketing its product for commercial purposes. Knippa is in the south central section of the state, almost due west of Galveston and about eighty miles west of San Antonio on the Southern Pacific Line.

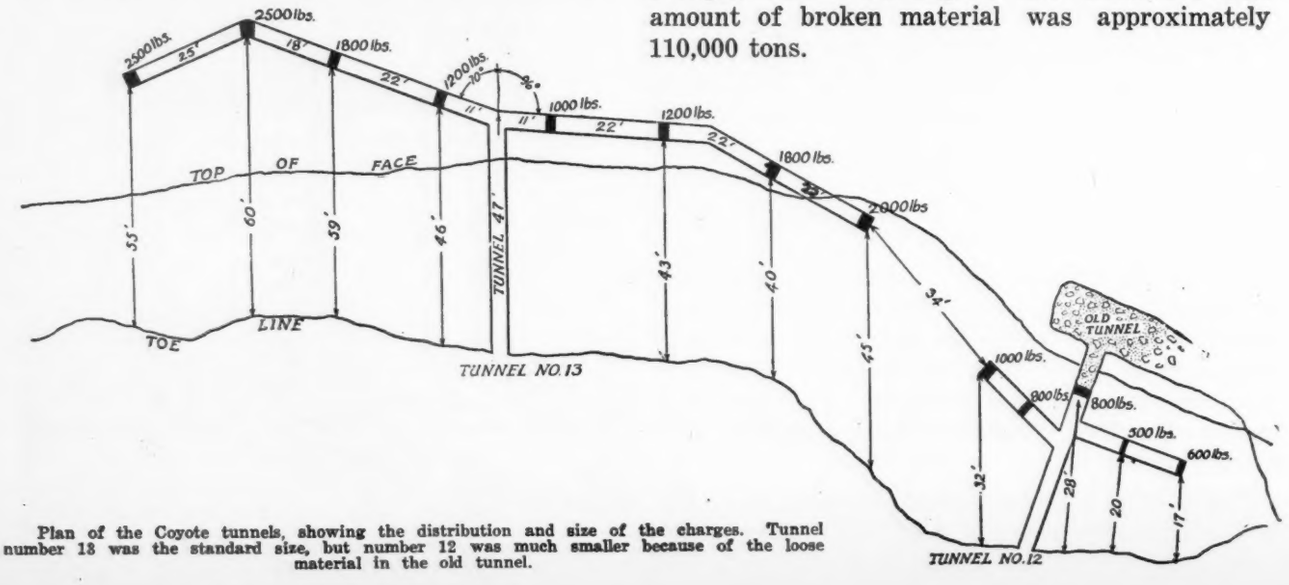
The highest point of the quarry extends one hundred feet above the floor. In working this trap rock deposit the coyote tunnel method of blasting is employed, for boring holes with well drills is impracticable because of the hardness of the rock and its columnar formation.

In preparing for a large blast last fall, two tunnels, A and B, were driven. The plan of the tunnels, which are numbered 13 and 12, respectively, and the distribution of the explosives charges, are shown in the sketch. Tunnel 12, the small one, was driven into a place where an old blast had been fired; and there was some question as to what action the explosives would take because of the broken material back of the charge.

After studying the conditions they decided that it would be better to place a charge heavy enough to move all of the burden above the broken ground, and to accept the chance of scattering the rock, rather than to risk not bringing the material down. Hence, this tunnel was loaded with 3,700 pounds of explosives.

Altogether 17,700 pounds of du Pont 60 per cent straight and durox were loaded into the pockets of the tunnels. The charges in both were connected by a double line of Cordeau and fired from the big tunnel side. And yet, the small tunnel shot was the first to break through on account of the lighter burden.

After the blast, it was estimated that between 90,000 and 100,000 tons of broken rock were brought down. Including the back break, the total amount of broken material was approximately 110,000 tons.



Plan of the Coyote tunnels, showing the distribution and size of the charges. Tunnel number 13 was the standard size, but number 12 was much smaller because of the loose material in the old tunnel.

AN INTERCHANGE OF ACCIDENT EXPERIENCE

By W. H. Cameron, Managing Director, National Safety Council*

The primary purpose of the National Safety Council is to assist its members in the interchange of accident experience, to make available to them the accumulated experience of their fellow members and the solutions they have devised for perplexing accident problems. This is accomplished through the "National Safety News" and other publications and through the Consultation Service comprising a clearing house of information on accident prevention.

In dealing with the question of statistical activities it should be understood that the Council is a purely voluntary co-operative association. It has no means of compelling its members to keep accident records or to send the records to its headquarters. The statistical tabulations compiled by the sections are made possible only by the voluntary co-operation of members willing to aid the cause by contributing the records of their experience—good or bad.

Although the original Constitution and By-Laws of the Council provide for the grouping of members into trade sections, the officers and committees have no means of compelling uniformity, nor do the terms of membership imply that all of the accident experience be contributed on any basis.

As the Council's membership has been expanded and the income from dues has grown to provide enough money to employ safety engineers competent to assist the voluntary committeemen, an effort has been made to induce the members within certain groups of industries to send their statistical data to our headquarters' offices for tabulation and comparison. The time is coming when each of the trade sectional groups will have salaried staffs to assist the voluntary officers and committees to dig deeper into the accident experience of each member within the group. It is now apparent that more data of this character can be secured through greater pressure upon the members, by visualizing to them the advantages of comparing experiences, and by encouraging those employers having bad records to study the methods of those having good records and eventually to correct the conditions that lead to high accident frequency and severity rates. These statistical records and comparisons of the members of the National Safety Council will never have the same comprehensive and inclusive comparative basis as the statistical reports of the national and state governmental bureaus. The Council is a propagandist institution. It aims to teach the public in a non-partisan way how serious the accident situation is nationally and to encourage employers and workers to wake up to the seriousness of the situation and to take steps to organize definitely for the prevention of accidents.

Even though the membership of the National Safety Council may increase greatly, and though it may be possible through persuasive methods to have a large percentage of the members interchange their statistical records, nevertheless it is probable that one of the continuing functions of the Council will be to encourage its members and others to comply generously with the National and State requirements for statistical records. Employers will be glad to give proof of their accomplishments when it is realized that a creditable accident record is an asset to the conduct of their business. The stigma of accidents is not yet a factor in industrial operations. The Council can help the administrators of the law to bring about this sensitiveness to public obligation.

It may interest you to learn of the brief story of the Council's efforts to collect and present the accident statistical records of eleven of the Sectional groups now contributing statistical information. These are: Automotive, Chemical, Construction, Metals, Packers and Tanners, Paper and Pulp, Petroleum, Quarry, Rubber, Textile, and Woodworking. Six other industrial sections are already sending their statistical compilations to other agencies, and the Council is not making an effort to compete nor to duplicate these reports. They are: Steam Railroads, now reporting to the Interstate Commerce Commission; the Public Utilities, reporting to the American Gas Association and the National Electric Light Association; the Mining companies to the U. S. Bureau of Mines; the Electric Street Railway companies to the American Electric Railway Association; and the Cement companies to the Portland Cement Association.

The members in the eleven industrial groups enumerated use the Council's standard report form requiring answers to the four following questions:

(a) Average number of employees for the year.

(b) Total number of hours worked by all employees.

(c) Number of accidents causing loss of time beyond day or shift.

(d) Number of days lost because of the above accidents.

The answers to the questions make it possible for our engineers to calculate the accident frequency and severity rates for each member reporting. Of course, these rates are figured on the nationally approved basis and provided for in our Safe Prac-

*An address delivered before the Industrial Accident Conference at Washington, D. C., on July 15, 1926.

tices pamphlet No. 21 entitled "Accident Records." Three of these sectional groups—Construction, Rubber, and Textile—have gone one step further. The members in these groups in addition to tabulating their accidents according to the standard report form also tabulate their accidents according to a standard cause classification. Of course, the recorded experience of these three groups is more valuable and efforts are being made to have the other eight groups also adopt standardized cause classifications. The Council will be glad to send to any inquirer copies of the Textile, Rubber, and Construction forms showing the standardized accident causes.

In the correspondence with the member, the Council points out that there are six reasons for collecting and comparing these accident statistics, viz:

(a) To promote uniformity.
(b) To arouse pride of industry.
(c) To secure direct comparisons.
(d) To trace the national trend of accident experience.
(e) To interest other companies in accident prevention, and
(f) To help each individual company in analyzing and correcting its own accident causes.

The Council impresses upon the member the need for uniformity in compiling accident records, emphasizing the fact that these uniform methods of calculation from year-to-year should be maintained in spite of changes in the personnel of the statistical department; that frequent changes in the method of compilation create confusion and misunderstanding. Uniformity makes it possible to compare the record of one plant with the record of others having similar accident records.

To illustrate what it means to arouse the pride of an industry, I may say that the cement industry claims credit for making greater progress in accident prevention during the past few years than any other industry in the country. This industrial group is proud of its record and broadcasts the information to all of its workers. When publishing the tabulated accident records of a particular industry the Council gives the record of each operating plant. The names of the plants, however, are not revealed. Each plant is given a key-number which is known only to the officials of that plant and to the engineering staff of the Council. These comparisons make it possible for the plant executives to see their standing with references to other plants in their same class. The plants at the top of the list are encouraged to continue to improve their present accident prevention methods, and those companies not doing so well are urged to do more and better work. Keen interest has been developed among the Paper & Pulp members of the Council by offering a "Paper Industry" silver loving cup to that mill having the best accident record for the first six months of 1926. The operating plant in this industry having the best record will be entitled to claim the honor of having the safest paper mill in America.

Of course, the compilation of these statistics makes it possible to trace the national trend of accidents within certain industries and leads to greater effort to ascertain the causes for increase or decreases. For example, the sixty-seven companies in the Automotive group reporting for the two years, 1923-1924, show an average increase of 22 per cent in frequency rate and an average increase of 167 in the severity rate. This record has stimulated these companies to greater effort, and the Council is given the opportunity to hammering away at the industry as a whole and at the companies that are not getting results. The following additional comparative records may interest you:

Nine companies in the Chemical industry reporting for the years 1923-1924, show decreases of 29 per cent in frequency and 27 per cent in severity.

Fifteen companies in the Petroleum industry, reporting accidents for 1922-1923, show increases of one per cent in frequency and 20 per cent in severity.

Five Construction companies reporting for 1922-1923, show a decrease of 23 per cent in frequency but an increase of 28 per cent in severity.

Thirty-one Paper and Pulp companies reporting for 1922, 1923 and 1924, show in three years decreases of 35 per cent in frequency and 16 per cent in severity.

Thirty-nine companies in the Woodworking industry reporting for 1923-1924, show decreases of 29 per cent in frequency and 7 per cent in severity.

Seventy-seven companies in the Metals industry, reporting for 1923-1924, show decreases of 15 per cent in frequency and 2 per cent in severity.

Typical reasons given for increases are: "Speeding up of production"; "Necessity for cheaper production means that less attention is given to Safety"; "Increased labor turn-over"; "Too much attention to Safety education and not enough to the problem of safeguarding new equipment."

These sectional statistics are used to secure the interest of individual companies not now taking an active interest in accident prevention. Many companies become interested by comparing their own safety records with those of other companies in the same industry. This leads to organized effort to combat the accident situation. Statistical records also help the Safety man to study his own records more closely. They help him to select the most important accident causes and to apply the most necessary remedies. The Safety man also uses these statistical records to emphasize to the executives and workers of the plant the need for more Safety effort. It is becoming clearer to the managers of

industry that statistical charts, tabulations, curves, etc. are invaluable in showing up the experience and loading to constructive effort.

The Council is distributing widely its pamphlets giving the approved methods of compiling accident statistics. It is preparing another pamphlet to be entitled, "Competition as an Aid in Promoting Accident Prevention." A section of this pamphlet will present methods for using these statistical records in accident prevention contests. Copies of this new pamphlet will be available to inquirers.

No one will deny the value of recording accident experiences. The problem is to convince industry, and particularly the 92 per cent that employ less than one hundred workers, that such recorded experience will reveal disgraceful economic and human losses. The extension of the United States Bureau of Labor Statistics machinery to collect, tabulate and analyze the data on industrial accidents in the United States will be a step in the right direction. Such institutions as the National Safety Council will cordially assist in the educational problem of keeping the records and in achieving the goal of minimizing the terrific and unnecessary losses of life and money.

British Utilize Slate Waste

About 85 per cent of the slate produced in Great Britain comes from the Welsh quarries, the output having been 236,854 tons in 1924. For every ton of finished slate there are at least 15 tons of waste; consequently, this waste presents a serious problem. It is usually dumped in huge heaps which detract from the picturesque scenery for which Wales is celebrated. Quarry owners are seeking a commercial use for this waste.

Some uses for this waste slate have been found. Ground slate waste has been made into excellent bricks. At the Penrhyn Quarries there is a special grinding plant to deal with the accumulation of waste from the slate planing table. The pulverized waste has been used with commercial success as a filler for asphalt, bituminous roofing, mechanical rubber, and for other purposes. These outlets, however, are not sufficient to absorb more than a small portion from the quarries.

The latest idea has been to use slate waste dust as a road-surfacing material. An experimental stretch of road at Blaenau-Festiniog, Wales, was so treated early last summer, and the result has been encouraging. There is a constant traffic of heavy freight and passenger automotive vehicles over this road, and the surface has stood up excellently to the test. The material used was not properly pulverized slate planings crushed in a mill, but simply dust collected from around the planing tables. The ideal mixture would consist of slate chippings and dust combined. The material is mixed with diluted glutrin, a substance obtained during the manufacture of wood pulp, until it can be mixed like an ordinary mortar, and is then applied to the road by hand or machine.

This coating of mortar on the road was applied to a depth of 2 inches on the crown and 1 1-2 inches at the sides. Over it was spread a layer of granite macadam to a depth of 3 inches, the latter being well rolled in. The whole was then allowed to set, the result being that a surface of the nature of concrete was obtained.

The bituminous macadam surface with which most British main roads are laid is superior to the slate dust and macadam surface, but it costs a great deal more. Consequently, there appears to be a future for the new road surfacing on secondary and other roads where the surface is merely macadam rolled in. The cost is only 12 to 14 cents more a square yard than the cost of the latter when labor and materials are included. The proportions of materials used are about 75 per cent of macadam to 25 per cent of slate dust. As the dust can be handled at a fairly cheap railroad freight rate—no more than that charged for macadam, which is sent long distances for road making—it is possible that his new road surfacing may find favor over an extensive area as soon as its advantages become more generally recognized.

There is so much more waste in the slate industry that this experiment should be observed with interest. There are other uses to which slate waste can be put. Sintered slate waste can be used for electrical work instead of porcelain, as it is a poor conductor. Even though it takes a high temperature to sinter slate, the cost will be much less than that of porcelain insulations. Machine mountings offer another possibility. Machine mountings can be made of any desired size from sintered slate waste.

The Big Buildings

There has been much speculation of late as to the comparative sizes of our big buildings. The following statistics concerning the world's largest buildings will be of interest.

Building and City	Cubic Feet
Equitable, New York	24,000,000
General Motors, Detroit	20,411,000
Union Trust, Cleveland	20,000,000
Railway Exchange, St. Louis	18,898,000
Illinois Merchants, Chicago	17,850,000
Continental & Commercial Bank, Chicago	17,000,000
Woolworth, New York	13,200,000
Straus, Chicago	10,000,000

THE IMPORTANCE OF THE INTERNAL COMBUSTION ENGINE

By W. F. Schaphorst

FOR many years alert engineers have been on the lookout for a prime mover more economical than the steam engine. The steam engine in itself is all right and is economical where coal is cheap, but as soon as coal becomes expensive a steam engine also becomes expensive and it becomes necessary to look around for something that will develop power at a lower rate per horsepower per hour.

Nearly all fuels are increasing in price these days and there is simultaneously a gradual diminishing of supply. Fuel must be saved. Not only for the purpose of saving money, but to save the nation's national resources. Years ago when fuel was cheap the engineer or owner went out and selected the type of prime mover that would give most reliable service, the type that was simplest, and that type that cost least. Efficiency did not "cut much ice." And inasmuch as the internal combustion engine and the electric motor were scarcely developed at that time the selection was almost invariably a steam engine and steam boiler combination of some kind.

Many of these steam power plants are still being used and they are now proving to be as costly as they were inefficient in the first place. When first installed they were satisfactorily economical but they were not efficient. Today they are not economical because they are not efficient. The cost of fuel has gone up. No doubt in many of our modern plants efficiency could be greatly increased by modernizing the system to some extent, by improving the boiler, including the setting, baffles, installing a soot blower, keeping the boilers clean, installing an economizer or feed water heater, insulating pipe to reduce radiation, and very likely in the engine room if more power is needed a great saving could be effected by leaving the old engine in place and installing a low pressure turbine to operate on the exhaust from the present engine. Such things are possible and have been and are being done.

A large number of plant owners have taken care of the problem satisfactorily by installing an electric motor and buying power from local central stations or from far distant central stations. And those who have faith in internal combustion engines have installed gas or oil engines and are now getting good results. Some owners who made practically no profit with the old steam plant in operation are now doing well from the savings effected alone by the internal combustion engine.

The internal combustion engine has made very rapid progress during recent years. Scientists have done much research and development work on them and have perfected them to the point where they are highly reliable and although the first cost may be considered high they are so highly efficient that they are actually economical because of the small amount of fuel they consume per horsepower hours.

Some people argue that because of the fact that oil fuel is so unstable in price it is not good business to install an internal combustion engine. However, it is a fact that the price of coal largely determines the price of oil and the two sort of go hand in hand. When there is a great demand for fuel oil due to the scarcity of coal the price of oil naturally goes up. And when coal is plentiful and its price drops the price of oil correspondingly drops. Therefore, even though the price does fluctuate the ultimate cost of fuel for use in the internal combustion engine is almost bound to be less than the total cost of coal fired under a boiler during the same period due to the fact that the internal combustion engine is so much more efficient and so much less fuel is required even of a fuel that may be slightly more costly.

Another common argument against the internal combustion engine is that it is more difficult to operate than the steam power plant. This is no longer true—at least it is less serious than it once was. In fact it is claimed by manufacturers of internal combustion engines that their engines do not require any more skilled attention than do steam power plants. There is less danger about an internal combustion engine. There is no boiler to explode. If anything goes wrong the internal combustion engine usually simply stops.

When installing an internal combustion engine take special care with the cooling system. Use water for cooling that will not deposit scale in the jackets. Be sure that the water circulation is perfectly free, positive and continuous. Also be certain that the engine is always well lubricated externally as well as internally. The care given an internal combustion engine, which of course includes lubrication, has everything to do with the maintenance of a high efficiency during a long and useful life in any plant.

Blaine Smith Enters Banking

The National Bank of the Republic of Chicago has elected Blaine S. Smith a director. Mr. Smith is vice president of the Universal Portland Cement Company.

COMPANY LIABLE FOR DEATH IN THIS CASE

By Leslie Childs

AS a general proposition of law a building material producing company, or any other enterprise for that matter, is not required to keep its premises in a safe condition for uninvited visitors. To this rule there is, however, a well defined exception in respect to children, which holds that the owner of premises may be liable for injury to a child, even though the latter is technically a trespasser, if the injury is caused by an unguarded danger which is attractive to children.

It is of course obvious that each case of this kind must necessarily be decided in the light of its particular facts, and general rules are of little value. However, as an example of the reasoning of the courts in situations of this kind, and the possible danger to the owner of a material yard for injury to children playing therein, the Illinois case of Ramsay vs. Tuthill Building Material Company, 129 N.E. 127, may be reviewed with profit by materialmen in general.

In this case the material company maintained an elevated switch track upon its premises under which bins were constructed for the reception of sand. There were chutes in the bottom of the bins by which the sand could be loaded into wagons. The tops of the bins were from 20 to 25 feet above the ground and the bottoms about 8 feet.

The premises upon which the bins were located was accessible from the street, and children of the neighborhood frequently entered thereon and played in the sand underneath the bins. Children also, it seems, had upon occasion climbed into the bins for the purpose of sliding down and out the chutes which were about 18 inches square. The material company had, it appears, told the children to stay away, but no effective means had been adopted to keep them off the premises.

On the day of the accident out of which this action grew, a 10 year old boy with his younger brother climbed a ladder to the top of the bins. The boy stopped at a bin which was nearly full of sand, and then jumped into the bin in an attempt to slide through the bin and out at the opening in the bottom. When the boy started sliding through the bin the sand came down upon him in such volume as to smother him to death. The administrator of his estate thereafter brought the instant action against the material company to recover for the boy's death.

In defense to this action the material company contended that the boy was a trespasser upon the premises; that he was not there by its invitation express or implied; that he was not attracted to the premises by any condition which was visible from the street. In view of which the material company took the position that it was in no way responsible for the unfortunate incident.

The trial of the cause in the lower court resulted in a judgment against the material company in the sum of $2,500 for the death of the boy. The material company appealed from this to the Supreme Court of Illinois, and here the court, in stating the general rule in respect to the liability of an owner of premises for injury to children by an attractive danger thereon, in part, said:

"It is not necessary to make a defendant liable, that the attractive and dangerous thing should be visible from the street and that children should have been attracted to the premises by it. If an owner maintains dangerous conditions upon his premises to which he permits children to come, he must use ordinary care to guard them against danger which their youth and ignorance prevent them from appreciating.

"There is no implied invitation from the mere existence of a dangerous attraction which is not discoverable off the premises; but, if to the knowledge of the owner children habitually come upon his premises where a dangerous condition exists to which they are exposed, the duty to exercise care for their safety arises, not because of an implied invitation, but because of his knowledge of unconscious exposure to danger which the children do not realize. * * *"

Following the above statement of the general rule in situations of this kind, the court directed its attention to a consideration of the facts of this case, in respect to whether or not the evidence was sufficient to hold the material company liable. In this connection the court, among other things, said:

"In this case it appears that for some time children had been in the habit of coming on the premises of the plaintiff in error (material company), playing in the sand on the ground, going up the ladder to the top of the elevated structure, jumping into the sand bins, playing in the sand there, and going through the openings in the chutes.

"This was known to the employees of plaintiff in error, who testified that they frequently told the children to stay away, but no effective means were taken to prevent their coming there; so that here the defendant (material company), by taking no effectual means to prevent it, permitted little children, too young to have judgment and exercise care to protect themselves from danger, to play constantly about its premises where it knew that they were habitually exposed to danger which they did not realize and which was likely to result in

serious injury or death to some of them, and which actually has resulted so.

"Under such circumstances, the owner of property is responsible for the injury which has occurred by reason of its negligence in failing to use adequate means to keep children away from the danger which it has created. * * *"

In conclusion the court affirmed the judgment in the sum of $2,500 rendered against the material company. Holding, as outlined in the opinion, that upon the facts and circumstances which culminated in the fatal accident, the material company had not performed its duty in respect to keeping children away from the danger upon its premises and was liable for the accident to the boy.

U. S. Good Roads Convention Live

Mr. J. A. Rountree, Director General, United States Good Roads Association, has returned to Birmingham after five months absence in California, where he conducted and arranged for the Fourteenth Annual Convention of the United States Good Roads Association which met in Santa Monica, June 7th to 12th. He reports that it was the most representative and enthusiastic Convention in the history of the Association.

The Association did most constructive work in endorsing and urging the passage of the Federal Aid Bill, also requesting Congress to increase appropriation from $75,000,000 to $100,000,000 for creation of park commissions and beautifying highways.

The Santa Monica, Ocean Park Chamber of Commerce, was the host on the occasion, conducting the raising of all funds and entertaining the Convention. A rising vote of thanks was given Director General Rountree by the Santa Monica, Ocean Park Chamber of Commerce for the splendid manner in which he conducted the affairs of the Association during his stay in that city. The United States Roads Association not only passed a resolution of congratulation and thanks which was the recommendation of six Governors and thirty-six other members of the Resolution Committee, but re-elected him Director General for the fifteenth consecutive term. Fourteen cities invited and contested for the nineteen-twenty-seven Convention—Morristown, Tennessee was chosen after a strong and spirited contest.

Among those attending were, Gov. Ben S. Paulen, of Kansas, Gov. W. J. Fields, of Kentucky, Gov. Clifford Walker, of Georgia, Gov. J. E. Erickson, of Montana, Gov. W. W. Brandon, of Alabama, First Vice-President of the Association who presided over the Convention: Gov. H. L. Whitfield, of Mississippi, who was elected president for the ensuing year.

Belts Today Are Better

By W. F. Schaphorst

In a recent number of a prominent publication a writer makes much ado about a belt, installed in a certain plant that saw 75 years of continuous service and was still good for more. The belt, he claimed, had never been dressed with a belt dressing. The claim is made in the article that leather belts were built better in "the old days" than today.

The writer can see no reason why a leather belt should not last 75 years or 100 years on a given drive where conditions are favorable to long life, as apparently was the case in this plant.

Where belt speeds are low, where the belt is ample in width, protected against sunshine and acid fumes, where the pulleys are sufficiently large in diameter and if the belt does not have the tendency to pound itself to pieces as is the case on so many high speed machines where pulleys are small,—then long life may be expected. The writer knows of belts that are 40 years old and that are still pulling full loads apparently just as well as they did on the day there were installed. I also know of a belt that has been installed for over 40 years—a beautiful slack belt—the remarkable thing about it being that it has never been shortened. As the superintendent has said about the belt: "It has never had a knife put to it." That is one of the advantages of a nice slack belt—the slack side automatically approaches the tight side as the stretch increases, but it so happens that in this drive ample belt proportions were used and when that is the case the stretch is practically negligible because the unit stretch is so small. In fact in all of the long life installations known to me the belts are good, wide, well proportioned belts. The designers were not stingy in giving the belts plenty of width and thickness.

However, simply because a belt will last 75 or 100 years without dressing is no reason why it should not be dressed, because there is no question but that when properly dressed with the right kind of dressing the belt will do better work, and it should be even longer lived than when not dressed in the same way that a pair of shoes will last longer and will look better if kept shined than if not shined. Unless leather is given the right kind of care it will eventually crack. But, of course, if used on large pulleys and if the stress is very very small, the danger of cracking is lessened.

The writer disagrees with the statement that belts made "in the old days" were made better than they are today. The best belts today are better than belts ever were. Take the matter of cementing belts, alone. In the "old days" there was no such thing as a waterproof cement. Today, a cement is used that is not soluble in water, and as a result joints will not part no matter how long they are soaked in water.

Select Steam Shovel with Care

By H. W. Munday

For quarry work, a steam shovel should be selected with great care. The size of the shovel is important, but besides this factor a shovel should be well built and able to stand the strain of the excessively hard work. Naturally for large productions and for handling stone that breaks up into large pieces, a large sized shovel should be used. Such a shovel will stand more hard work than the smaller machines, yet there are many cases where small shovels are being operated successfully in quarries. Some operators who have used small shovels seem to prefer a greater number of shovels of the size selected, rather than a small number of the larger sizes.

There are some special conditions in quarries that must be met, that may at times make it difficult to operate shovels, but, generally speaking, if a quarry is developed to use shovels, and the proper preparations are made, there is no reason why shovels cannot be operated successfully. In one case where a shovel was tried, and then taken out of the quarry, the failure was due entirely to attempting to use the track layout that had been employed for hand loading. This meant slow operation, and it may have been true that quicker and more economical work could have been done by hand methods. If the proper arrangements had been made and trains installed with some motive power, a shovel would, no doubt, have proved successful.

In another case, with a very high ledge, frequent slides of stone occurred, and it was considered too dangerous to work there. Consequently the shovels were put on side tracks and offered for sale. In a case like this, it would certainly seem possible and feasible to have so blasted the rock and thrown it down ahead of the shovel, as to prevent the danger of slides. If this had been done, the steam shovel would, no doubt, have been successful.

In every case, where shovels have been tried and have not proved satisfactory it will be found that there is some reason or difficulty. If the proper investigation is made this can usually be overcome. It is quite difficult when the various conditions are not known to suggest remedies or ideas that may allow one to operate a shovel in a quarry. It will be very interesting to other readers of this paper, if producers will write to the editor telling him of their experiences in operating shovels in quarries, not only those that have been successful, but also those operators, who have put shovels to work and then taken them out. With information thus obtained it may become profitable to make some helpful suggestions. In telling of these experiences, information should be given as to the kind of rock, height of ledge, and the kind of grades that the trains must operate over. Photographs may also be useful.

Another factor that enters into the use of steam shovels is the size or type of crusher that may be installed in the quarry. It is possible that, if stone must be broken very small for the crusher, one of the greatest advantages of the steam shovel is lost, for shovels play an important part in handling sizes of rock that men cannot handle without breaking.

Steam Pipes Are Often Too Small

By W. F. Schaphorst

As fuel is continuing to increase in cost, it is urgent that we pay more attention to the size of our pipe lines, particularly steam pipe lines. If there is anything that is liable to cause a tremendous waste of heat it is a steam pipe or heating coil that is too small.

Take for example the possibilities of use of exhaust steam. Exhaust steam has a temperature of at least 212 degrees Fahr. when released to the atmosphere. It is therefore capable of heating liquids and gases to a temperature of nearly 212 degrees Fahr. However, very seldom do we find instances where waste is made to heat to a temperature of 212 degrees. The method that is easiest and that costs least at first is to use small pipes and high pressure steam is employed to do the heating. The pipes are usually so small that the sufficient exhaust steam cannot get in, consequently higher pressure steam is needed. The exhaust steam that should be used instead is wanted because it cannot be gotten into the small pipeline in sufficient quantity. This, therefore, may double the amount of waste steam at atmospheric pressure.

Sometimes where exhaust steam from steam engines is used the back pressure is allowed to build up to such a great extent (because of the small pipes that are provided for utilizing exhaust steam) that the engine capacity is greatly reduced requiring the installation of an additional engine. Larger pipes for handling exhaust steam would solve these problems in many cases yet this is a point that is seldom thought of because engineering practice has apparently standardized on comparatively small sizes of exhaust piping.

Before buying equipment that must be heated with steam, it often pays to look into the possibility of using exhaust steam. It is well to make a study of the relation between the temperature , pressure, and volume of steam. Knowing the exhaust pressure, the temperature can be found from steam tables. The volume can also be found. Then, knowing the volume, it is an easy matter to comput the sizes of pipe or coil needed and it is also possible to determine to a surprising degree of accuracy just what the proper and most economical steps would be.

Hydraulic Stripping Should Be Considered

By H. W. Munday

A quarryman recently said: "You hear much about hydraulic stripping of quarries, and in many articles upon the subject such details are given as to show how the work is done, and the benefits derived, yet nothing is told of when this method can be used and the conditions that must exist to make it practical."

These conditions can be found when the quarry is a wet one and it is necessary to have large pumps to keep the quarry or pit dry. In most cases, though, few quarries or sand or gravel pits produce enough water to do much stripping, but this can sometimes be overcome by having the pumps connected up to another supply so that they can be used for both unwatering and for stripping. When washing must be done it is also possible to use the pumps for the double duty of washing and stripping, thereby saving on the plant charge for the last named work.

These facts show the need in hydraulic stripping for an ample supply of water that will not need large and expensive pumps or a specially designed plant to do the work. The height or lift needed for the water together with the amount of water and the pressure needed will govern these points. The fact that this method of stripping cannot be done unless there is an ample supply of water calls attention to the need of providing a storage of water when the ordinary flow is not sufficient to do the work. Water thus becomes the first consideration in deciding upon this method.

The second is the character and size of the pumps to be used. This is governed by the height to which the water must be raised, the amount needed and the pressure of the water at the nozzle of the pipe.

It is possible at times in the mountains to bring water down by gravity for the purpose, from a large spring or reservoir made across some spring. In this way a great head or pressure can be obtained so as, not only to cut earth, but to move boulder or fissured rock. In such cases pumps are not needed, and naturally the stripping can be done at a low cost. Another factor that plays a prominent part in this method of stripping is available ground to place the spoil. This is a liquid and must be retained in some way so that it will not be spread over adjoining property and injure it. Without such a spoil bank, this method cannot be used. The spoil is generally held in place by means of brush and logs or boulders. At times old timbers are used if they can be obtained cheaply, for cribbing, and thus the spoil is held in place.

There must always be a way for the water to run away from the spoil, and thus water must be caught in trenches or troughs and carried away. This means there must be some place to carry the water to and thus get rid of it. If there is a stream close by the water can be disposed of by means of it, but inasmuch as a sediment is deposited in the stream, other property owners may object, or the government may not permit it if the water is navigable. At times the water can be directed into a reservoir or settling basin, and be used over for the stripping work.

There must also be troughs or pipes to carry the water from the stripping operations to the spoil banks. These must be built on such a grade that the spoil is not deposited in transit. This is likewise important as money can be wasted in having to clean the pipes or trough. These are the salient features in carrying on the operations of stripping soil by hydraulic sluicing.

Rebuild Ball Bearings

By W. F. Schaphorst

Not long ago I was conducted through a factory that is devoted exclusively to the rebuilding of ball bearings. The experience was unusually interesting and instructive. I learned that not only can ball bearings be rebuilt but the president insisted that the finished product is usually better than the original. In fact the company "guarantees" that their rebuilt bearings will give service at least equal to that of a new bearing when used under the same conditions.

Before rebuilding they minutely inspect the old bearings. The original balls and retainers are junked. If the rings do not measure up to the S. A. E. tolerance limits they, too, are junked. Then, the remaining rings are given a scleroscopic test for hardness. This test eliminates all rings that are improperly heat treated, fire cracked, burned, or that have been over-heated due to improper lubrication.

Then, the outer rings are reground and the size of ball to be used is determined. Next, the inner ring is ground to fit. A new brass retainer specially designed is used in each rebuilt bearing. A new retainer is necessary owing to the fact that larger balls are required in rebuilt bearings than in new. Lastly, the bearing is cleaned, inspected, dipped in a special hot petrolatum and wrapped in waxed paper.

A strong argument favorable to the rebuilt bearing is that carefully inspected rings that have seen ACTUAL SERVICE are preferable to new rings that have never been in service.

Another good argument is that because of the larger balls used in rebuilt bearings a greater load carrying capacity is assured. The larger the ball, the better.

Save on Transmission

By W. F. Schaphorst

In these days of power plant economy, don't neglect your transmission friction. It is possible to save much coal by taking good care of the old bearings, by installing new bearings of the ball or roller type, and by keeping the belts in good pulling trim.

A good way to determine the saving due to lessened transmission friction is to take an indicator diagram on the driving engine, with all machines running idle. That is, make the machines run, but do not allow the workmen to do any work in or on them while you are taking the diagram. The diagram thus taken will be a true "friction diagram." Its area represents the energy lost in carrying power from the engine to the work. In large mills, the area of this diagram is often appalling almost. It is so large that when the engine is running at "full load," the difference in area of diagram is scarcely noticeable. The friction may be as much as 70 per cent of the total power consumed.

Now, if we could reduce friction to zero, and if we could make the engine run with a mechanical efficiency of 100 per cent (both impossibilities), we should have an indicator diagram of zero area. This would be an "ideal" state of affairs. It cannot be attained, of course; but it can be approached ninety times in a hundred, and that is exactly what we should all strive to do; make your friction diagram area as small as possible.

Therefore, after taking your diagram, go over all your bearings carefully; clean them; rebabbitt where necessary; remove all knocking, backlash, play; oil them with good oil or grease; and if the shaft is scored; true it up. If the bearing is an important one through which considerable power passes every day in the year, 10 or 24. hr. a day, it will probably pay you to change over to a ball bearing type. They are great power savers, and as made nowadays are proving themselves to be surprisingly durable.

Go over all belts, transmission chains and rope drives. Do not permit slip of any kind, for it must be remembered that each per cent of slip means a direct loss of one per cent of coal. Keep the belts in good, pliable running order. Release excessive tensions where it is evident that such tensions are creating uncessarily high friction in the bearings. Do not sancton hard, stiff belts.

After doing all of these things, and instructing the men to oil machines properly, take another friction diagram. You will find a considerable reduction in area if your transmitting mediums were in bad order theretofore.

Money Saved By Ball Bearings

By W. F. Schaphorst

An instance has been brought to the attention of the writer where, by the installation of ball bearing hangers, and the installation of ball bearings on line shafting, 25 per cent less power is now required than formerly. The entire plant has been equipped with ball bearings. A report concerning this plant contains the following interesting information in one paragraph:

"One section supplied by a D.C. generator required between 1,600 and 1,800 amperes at 130 volts when babbitt bearings were used. The same load is now handled with a current of 1,200 to 1,300 amperes which shows that the minimum reduction is about 25 per cent of the original load. The power saved per day is 468 Kilowatt hours which in a year's time at $.02 per Kilowatt hour is worth $2,808. As this section of the plant takes about one-third of the total amount of power used, the saving from the use of ball bearings in the entire plant would be approximately $8,424 per year."

According to the manufacturers this report shows that the saving due to the installation of ball bearings

will pay for the complete installation of ball bearings in less than two years.

We also read and hear much criticism concerning the life of ball bearings. We are given to believe that ball bearings are short-lived. The manufacturers of the above ball bearings however, claim that their bearings have been used steadily for 10 years. In this connection they say that ball bearings, "Cost more than babbitted bearings of course, but they pay back the difference in cost, in power saving alone, in less than two years' time, and after that they are earning a clear profit."

New Vibrating Screen

The Robins Conveying Belt Company has recently announced the addition to their line of screening equipment for sand, gravel, crushed stone, and similar material, of the "Vibrex" screen. It is claimed that this unit possesses the important feature of extreme simplicity, together with a number of distinct advantages which cannot be found in combination in any other similar unit.

The "Vibrex" screen consists of three main parts; a vibrator driven by a belt from a motor of the countershaft; a live screen frame; and a stationary base frame which may be readily attached to supporting structures.

Four adjustable unbalanced collars mounted on the vibrator drum give a variable amplitude of vibration to meet different conditions. The drum itself is carried by means of Timken roller bearings on a transverse shaft rigidly connected to the live screen frame.

The screen frame is connected to the base frame by ten coil springs, which perform the double function of absorbing the vibration of the screen, and maintaining tension in the screen cloth proper, which is clamped in readily removable grips.

The fact that the entire screen frame is uniformly vibrated eliminates dead and inactive areas of screen surface. Furthermore, long life of screen cloth is claimed for this type of construction, as there is no flexing of the individual screen wires. The supporting springs minimize escaping vibration and consequent power loss, the unit requiring less than 1 h.p. to operate.

The screen cloth is easily changed and it is recommended that a spare set of clamp plates be kept on hand and secured to the new cloth in advance, it then being possible to remove the worn-out cloth and set the new one in its place without much loss of time.

Maintenance is reduced to a minimum, two points, one at each end of the vibrator shaft, requiring lubrication with an "alemite" gun at intervals of one month.

Where desired, the "Vibrex" screen is constructed with the drive motor secured to a platform mounted on the base frame, thus forming a self-contained unit. It may also be equipped at slight extra cost with an enclosing structure for the prevention of escaping dirt and dust. Where large capacities are to be handled, convenient multiples of the individual screen unit are available. The manufacturers have recently issued Bulletin No. 67 which describes the "Vibrex" screen in full.

Diamond Drills

The Diamond Machine Company manufacture an electric rock drill which has been successful in some of the largest quarries, mines and tunnels where rapid production in drilling is demanded at a low cost. This drill is known as type "A" and it was not placed on the market until after five years had been spent in development and tests in actual mining operation under severe and varied conditions.

The drill is of the rotary hammer type, operated by an electric motor attached to the frame proper by means of studs and bolts. The mechanism of the drill consists of two parts, a revolving helve containing the hammers and the drill holding chuck. The revolving helve or striking mechanism is driven by an endless belt provided with a belt tightener which permits variations in speed.

The drill mechanism is enclosed with a cast steel casing to protect the working parts from injury or foreign substance. The rotation of the drill steel is provided by means of a worm gear reduction from the helve shaft. A friction cone mounted on the worm gear shaft protects the gears and motor from any undue strain in case the rotation of the drill is suddenly checked. The motor may be either 115, 230 or 550 volts direct current or when using alternating 25 or 60 cycle, 2 or 3 phase with voltage of either 110, 220 or 440. When arranged in the drill the motor is fully enclosed, splash proof and capable of successful operation in wet places.

Recent Patents

The following patents of interest to readers of this journal recently were issued from the United States Patent Office. Copies thereof may be obtained from R. E. Burnham, patent and trade-mark attorney, Continental Trust Building, Washington, D. C., at the rate of 20c each. State number of patent and name of inventor when ordering.

1,588,563. Mining-machine. Walter J. Wilson, Sewickley, Pa.

1,588,564. Mining and loading apparatus. Walter J. Wilson, Sewickley, Pa.

1,588,728. Process of making artificial stone. Adolph Herscovitch, Montreal, Canada.

1,588,838. Cut-off for gravel bins and chutes. Forrest R. Jones, Knoxville, Tenn.

1,588,841. Composition for concrete blocks and method of using the same. Ernest A. Knapp, Toledo, Ohio.

1,588,987. Method of mining. Edward O'Toole, Gary, W. Va.

1,588,994. Skip hoist. Alvin C. Rasmussen, Indianapolis, Ind., assignor to Insley Mfg. Co., same place.

1,588,998. Head-frame for mast-hoists. Carl G. Schmid, Indianapolis, Ind., assignor to Insley Mfg. Co., same place.

1,589,529. Hand loader for concrete-mixers. William B. Holland, Sydney, New South Wales, Australia.

1,589,598. Treatment of concrete floors. Daniel W. Kessler, Washington, D. C.

1,589,650. Compound for waterproofing Portland-cement concrete. Edwin C. E. Lord, Washington, D. C., dedicated to the public.

1,589,907. Material-moving apparatus. Garrett T. Smith, Chicago, Ill., assignor to Sauerman Bros., same place.

1,589,740. Pulverizing-mill. Louis C. Bonnot, Louisville, and William M. Barker, Canton, Ohio, assignors to Bonnot Co., Canton, Ohio.

1 589,741. Pulverizing-mill. Louis C. Bonnot, Louisville, and William M. Barker, Canton, Ohio, assignors to Bonnot Co., Canton, Ohio.

1,590,192. Excavator. Arthur M. Hood, Indianapolis, Ind.

1,590,193. Excavator. Arthur M. Hood, Indianapolis, Ind.

1,590,255. Mine-car. Hugh W. Sanford, Knoxville, Tenn.

1,590,523. Process of making artificial marble and stone. Otto Kell, Des Moines, Iowa.

1,590,542. Tamping mechanism for concrete-block machines. Layton M. Parkhurst, Indianapolis, Ind.

1,590,585. Mining-machine. Jacob M. London, Brookville, Pa., assignor to Sullivan Machinery Co., Claremont, N. H.

1,590,662. Power shovel. John R. Zygalinski, New Haven, Conn.

1,590,744. Concrete tile. Arthur G. Hatch, Duluth, Minn.

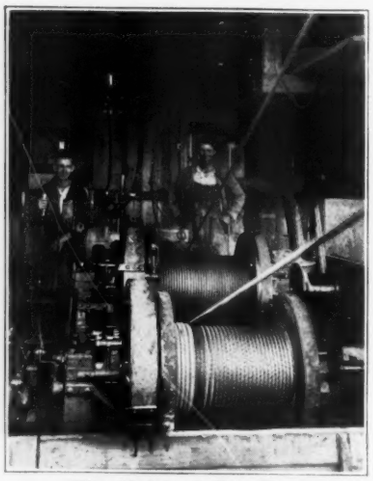
THEY WERE THOMAS HOISTS

In the May 15th number of Pit and Quarry there was an illustrated article featuring the operations of the Granite Sand and Gravel Company, at Indianapolis. In the description the hoists used in this plant were incorrectly named. All the hoists being used by the Granite Sand and Gravel Company are Thomas hoists, of which three are 90 h.p. two-speed machines. The three 90 h.p. Thomas hoists are used on the three slack line cableway plants. It is interesting to note that the Thomas Elevator Company was the first to introduce a two-speed slack line cableway hoist. Thomas hoists are now available in sizes ranging from 20 to 200 h.p. in steam, gas or electricity.

The Stilwell Sand and Gravel Company of Anderson, Indiana, also use a Thomas hoist. They are operating in a dry pit and are obtaining a production of 24,000 yards of material per month. Their material is excavated by means of a dragline of their own design. As they sometimes have occasion to work in the dark, lamps are mounted on the stiff leg in order to give the operator a view of the digging operation. As stated, the dragline is of their own design, and they use a 2 yard special drag bucket, which they had made locally. The dragline is operated by a Thomas 90 h.p. double drum hoist of the band friction type with attached boom swinger. Their material is loaded on cars and carried to the hopper where the material is washed and screened. Stephens-Adams Company screens are used. Their oversize is prepared in an Allis-Chalmers crusher.

The Spy Run Sand and Gravel Company is an old established sand producing company, having a plant located between Garrett and Fort Wayne, Indiana. They also use a Thomas hoist. They enjoy a very good market for their material, the market being in Fort Wayne. As there has been considerable building work in Fort Wayne, they have enjoyed their good outlet through this source. However, due to their location, they are able to serve a number of points. Besides furnishing material for building operations and road contracts, they also have an outlet for their material in a small cement block plant located nearby.

The plant shown in the illustration



The Hoist at Spy Run

is a comparatively new one and the arrangement of their bin shows some originality. The front dump type of bucket digs the material and elevates it to the grizzly. The material is then washed, screened and graded, Stephens-Adamson screens being used. The material is loaded into cars on a siding which comes close to the bin. The Spy Run Sand and Gravel Company had the Interurban Siding installed at a great cost. This however gives them a convenient means of loading their material.

The Spy Run Sand and Gravel Company are getting a very good production from their plant. They are producing an average of about 16,500 tons of material per month; their aggregate consists of 60 per cent sand and 40 per cent gravel. This is rather exceptional production to be obtained from a one yard front dump bucket with a 55 h.p. Thomas two-speed slackline cableway hoist. The hoist is nine years old and has given them good service on previous operations before being installed in this new plant. The hoist is doing more than its rated capacity, but it is not unusual to find one of these hoists doing more than the manufacturers say it will do.

Among the other leading sand and gravel plants in Indiana using Thomas two-speed hoists will be found:

The Richmond Gravel Company, with a 100 h.p. machine.

The Delaware Sand and Gravel Company, with a 100 h.p. machine.

The Maxwell Gravel Company, with a 100 h.p. machine.

The Stevens Gravel Company, with a 75 h.p. machine.

Kirkpatrick Gravel Company, with a 75 h.p. machine.

Meron Gravel Company, with two 150 h. p. machines.

Brown & Huffstetter, with a 90 h.p. machine.

The Columbus Gravel Company, with a 75 h.p. machine.

Throughout the country will also be found many other companies noted for their large production of non-metallic minerals in which Thomas hoists play a prominent part. Some of these are:

The U. S. Gypsum Company,

J. E. Carroll Sand and Gravel Company,

McGrath Sand and Gravel Company,

Ward Sand and Gravel Company,

J. C. Stewart Sand Company,

Coon River Sand and Gravel Company,

Tavern Rock Sand Company,

Leathem D. Smith Stone Company,

Cedar Grove Sand and Gravel Company.

The Plant of the Spy Run Sand and Gravel Company

New Lime Operation

After several months of investigation, officers of the Black Marble and Lime Company have announced their development plans, at a meeting of the Enterprise, Oregon, Chamber of Commerce. In brief these include the following:

Emphasis on lime production, this seeming to be the most profitable field.

Immediate construction of four kilns and a hydrating plant on the railroad track at Enterprise.

Construction of an aerial tramway from the quarry to this plant to bring down the rock.

New Electrical Publication

"Industry's Electrical Progress" is the title of an interesting publication issued by The Cutler-Hammer Manufacturing Company. The author starts out to prove that the competitive advantages, which electric power brings to industry, lie in the effectiveness with which electricity is utilized. He has produced a book which any business man connected with a manufacturing company should read.

After showing that the consumption of electricity for industrial purposes has increased 3,000 per cent since 1905 —and almost doubled since 1921, the book points out the progress which has likewise been made in electrical equipment, particularly, in motors and motor control apparatus. Then it gives numerous examples of the accomplishments of correct motor control equipment. Many photographs of actual installations are shown.

Altogether, the book is one worth reading and worth keeping. The Cutler-Hammer Manufacturing Company offer to send a free copy to any one requesting it on their letterhead. The address is 189 12th Street.

Orton Cranes

The Orton Crane and Shovel Company, has issued bulletin number 41 describing their model T and E convertible gasoline — steam — electric cranes.

These cranes possess several interesting features such as separate clutches for the several operations, differential type of steering and the flexible crawling tread. Each of the various features in these machines is described in detail in the bulletin. General specifications of the two types are also given as well as engineering data, thus affording a useful booklet.

Worthington Locomotive Feed Water Heater

The Worthington Pump and Machinery Corporation have issued a bulletin, number BK-1607-D to describe their locomotive feedwater heater and boiler feed pump.

This heater is known as the open-type and its principle is, to heat the boiler feed-water by direct contact with the exhaust steam from the locomotive; recovery of the water resulting from the condensation of the exhaust steam used in heating as well as all the heat of this water; delivery of the heated feed water together with the water of condensation, direct to the boiler.

The manner in which the heater operates is illustrated by a sectional detail of the device, the path of the water and steam being denoted by arrows. Photographs are reproduced in the book of domestic and foreign locomotives to show the almost universal application of this heater. Graphs and table given in this booklet help in making this work valuable for not only the layman but also engineers interested in the development of the locomotive.

Westinghouse Engineering Executives Promoted

Mr. Francis Hodgkinson, for many years Chief Engineer of the South Philadelphia Works, Westinghouse Electric and Manufacturing Company, has been appointed consulting mechanical engineer, and Mr. A. D. Hunt has been appointed manager of engineering for the same company.

In April, 1925, Mr. Hodgkinson was the recipient of the Elliot Cresson Gold Medal presented to him particularly in recognition of his important part in the development of the steam turbine. Mr. Hodgkinson was born in England and was educated at the Royal Naval School, New Cross, London, from where he graduated in 1882.

Mr. A. D. Hunt, the new Manager of Engineering, has been connected with the Westinghouse Company for a number of years, occupying the position of manager of steam service at the South Philadelphia Works. He was born in Tarrytown, New York, and received his school education in Connecticut and the State of New York. Eventually he entered Cornell University from which he graduated in 1905 with the degree of mechanical engineer.

Phelps and Schmid Form New Connections

Charles G. Phelps, Paterson, New Jersey, announces that he and Charles J. Schmid, his associate, have been appointed metropolitan New York and northern New Jersey representatives for the Uehling Instrument Company, the Williams Gauge Company, the Combustion Control Division of the A. W. Cash Company and the National Boiler Protective Company. Mr. Phelps still retains his former connection with Uehling as treasurer of that organization. Mr. Schmid was formerly the Boston representative of the Uehling Instrument Company.

New Agents for Am. Pulverizer Company

A. M. Lockett and Company, Queen and Crescent Building, New Orleans, Louisiana, represents in Louisiana and southern Mississippi the American Pulverizer Company. Also the Titzel Engineering and Equipment Company is their representative in western Pennsylvania, West Virginia and western Virginia.

Ruggles-Coles Dryers

A new catalog known as number 16A has recently been issued by the Ruggles-Coles Division, Hardinge Company, Inc., describing their various dryers and uses.

A very complete list is given of the various materials which can be dried successfully in the machines made by this company, and the particular type of drier best fitted for each material is also discussed at some length. An interesting feature is worth noting connected with the policy of this company, namely, the keeping of spare parts in stock ready for shipment for those units which require replacement.

This is of value, as when repairs are necessary, spare parts can be easily and quickly obtained, the machine shut down, the replacement made and the machine put into service with the least loss of time or expense caused by a shut down.

Several pages are devoted to description of details employed in the construction of the machines and show their high development from an engineering and constructive viewpoint.

General dimension tables giving the floor space required are an asset to a plant when ordering new equipment. Tables of data connected with the drying of material are also included in this catalog which are presented in such a manner as to be of value to the engineer or executives to retain for reference.

The catalog is well written, with illustrations of details, complete installations and tables to form a useful and valuable book.

Morris Hand Cranes

Herbert Morris, Incorporated, have recently issued a new book, number 104, describing their new cranes. This book is a radical departure from the usual catalog style of book in that it contains half tones of the various types of cranes made by them and on the facing page is furnished a line drawing giving dimensions of the several elements which are important to be known by a prospective buyer or user.

Details of the various elements used in their crane construction are also illustrated. The book is well prepared and should prove of engineering value to all users of hand operated overhead cranes.

The Climax Engineering Company, Clinton, Iowa, announce the appointment of the H. J. McClenahan and Company, 615 Water Street, Baltimore, Maryland, as official parts and service station of Climax Engines.

A NEW BUCYRUS SHOVEL AND DRAGLINE

The Bucyrus Company of South Milwaukee, Wisconsin, have recently introduced a new development, a 41-B, 1¼-yard shovel, which has been built primarily for those jobs of excavation where capacity greater than that offered by a 1-yard dipper is needed.

The shovel shown in the illustration has a two part hoist and is quickly and easily convertible to a dragline. The shovel is designed so that the drum speed is the same for dragline or shovel work. Therefore all that is necessary to convert the shovel to a dragline is add the drag drum, change the booms and cables and add the fairlead. The drag drum is mounted well back on the shovel giving the desirable long lead from the fairlead to the drum.

As a dragline, the machine is offered with a 40-foot boom and a 1-yard bucket or a 45-foot boom with a ¾-yard bucket.

The capacities offered by this machine, both as a shovel and a dragline have proven very popular, especially for the larger excavation jobs and for work outside the cities.

Except for the larger capacities and working ranges, making correspondingly heavier working parts, the Bucyrus 41-B is a companion machine to the Bucyrus 31-B, the one-yard shovel recently announced by this company.

Details for the machine are box girder boom, outside dipper handles, two part hoist working over a larger diameter sheave, cast base and revolving frame, and caterpillars employing larger diameter roller and tumblers. It takes its place midway between the 31-B 1-yard shovel, and the 50-B, a 1¾-yard shovel.

Bucyrus now offers caterpillar mounted revolving shovels in three classes, Small Revolving Shovels; Mine and Quarry and General Utility Large Revolving Shovels; and Stripping Shovels, with dipper capacities ranging from ¾ of a yard to 8 yards. Bucyrus Dragline range in size from ½-yard to 8 cubic yards.

New Bucyrus Shovel

C. W. Fisher Comes to Chicago

C. W. Fisher, for two years associated with the McMyler Interstate Company in the sales engineering department at Cleveland, has just been named to head the Chicago branch of the firm.

In his new capacity as Chicago manager, Mr. Fisher will have charge of engineering and sales on the standard products of the McMyler Interstate Company for the Upper Mississippi district, which includes Illinois, Indiana, Wisconsin and parts of Minnesota and Nebraska.

Officials of the McMyler Interstate Company report that expansion of branch activities in the Chicago district has become necessary to meet the constantly increasing calls for equipment manufactured in the Cleveland plant. The products for which Mr. Fisher will be responsible through the Chicago office include steam shovels, gas shovels, locomotive cranes, clam-shell buckets and like equipment.

B. M. Horter Goes to Boston

Mr. B. M. Horter, formerly of the Philadelphia office of The Cutler-Hammer Manufacturing Company, has just been appointed manager of the company's Boston office. He succeeds Mr. J. M. Fernald, who has resigned to enter a different field of business.

New Pyro-porous Gas Filter

Gas filtration is unquestionably the most important problem in connection with flue gas analysis. The standard Pyro-porous filter, is well adapted to exclude soot and fine ash from the sampling line in ordinary boiler practice. This filter is placed on the end of the gas sampling line within the boiler or flue and as the hot gases enter it, the soot and ash deposit on the outer surfaces of the porous refractory discs. Such deposit, being in itself very porous, does not interfere with gas flow, hence the discs require no cleaning or replacement, it is claimed, for years.

For certain special applications, however, the standard filter is unsuitable, because of the impingement of incandescent particles of ash against the discs, which action seals the pores by causing a slag film to form over the surface of the discs, shutting off the gas flow. This is likely to happen in cement kilns and in certain metallurgical processes. It can also happen when burning fine coke braize on chain grate stokers or powdered fuel by air blast. In the latter cases the particles of ash may be in a molten condition when they strike the filter, even though the filter is located in a position in the last pass where the flue gas temperature is not over 400 or 500 degrees fahrenheit.

This slagging action is completely prevented and the filtering discs protected indefinitely against sealing up by means of metal shields which are now applied to a new special Pyro-porus filter. This filter is made by the Uehling Instrument Company and the manufacturer guarantees it to work effectively under any conditions between 200 and 1,400 degree fahrenheit. For higher temperatures, other special features are necessary.

Hanson Now Represents the Golding Company

Mr. G. G. Hanson has been appointed western representative of the Golding Sons' Company and the Erwin Feldspar Company, Incorporated, and will represent these two companies in the sale of feldspar, kaolin, ball clays, sagger clays and cornwall stone in the states of Missouri, Kentucky, Illinois, Michigan and Wisconsin.

The Kuhlman Electric Company, Bay City, Michigan, manufacturers of Kuhlman Power, Distribution and Street Lighting Transformers, announces the appointment of the Continental Sales and Engineering Company, 839 Oliver Building, Pittsburgh, Pennsylvania, as District Representatives in Pittsburgh. Mr. E. J. Hughes is the manager of the Continental Sales and Engineering Company.

MORROW DEVELOPS STANDARDIZED UNITS

The Morrow Manufacturing Company are following the trend of modern engineering practice in the development of assembled standard units for the processing of sand and gravel. The equipment manufactured by this concern is of two types, feeder and elevator, and in three capacitiese, 20, 40 and 60 cubic yards per hour. These standard units are so designed that the feeder, revolving screen and settling tank are complete units in themselves. This makes it possible to install a screen or feeder or settling tank and have a complete working unit.

These sub-units are all carefully assembled and tested at the factory before being shipped to insure accuracy in manufacture and subsequent operation.

The assembly illustrated is a 40 yard feeder unit and includes the latest development and improvements in design of this company.

The central drive, shown at the right of the half tone is assembled as a unit on a structural steel frame and mounted on the screen frame at the intake end. The screen is revolved by means of a cast iron gear which meshes into a pinion in the center drive. All the moving parts are revolved from the center drive. On the ring gear is cast a trunnion ring. The face of this ring has been accurately machined and a steel tire lightly pressed on, this tire being held in place by cap csrews. With this arrangement, by removing the screws the tire can be easily and quickly changed when desired. The screen is supported at the drive end by the trunnion ring and steel rollers.

The screen frames are of structural steel construction, riveted together to form a box type design. All members are securely braced and riveted to provide the desired rigidity.

Holes are punched in the main I beams to bolt wood members used for fastening skirting boards.

The screens are of the revolving type and at the exit end is placed a cast iron spider in which is mounted a stub shaft of generous proportion. Between the ring gear, feeder end, and cast iron spider are heavy T bars the full length of the screen to provide the desired rigidity of this element. The perforated screen plates and scrubbing chamber plates are bolted to these T bars. The scrubber is the mixing type.

Feeders are the Morrow Cradle type of structural steel construction. The upper portion is a hopper with specially designed throat on which is mounted the cradle feeder. A slide valve mounted in the throat of the feeder regulates the flow of material. The movement of the material in the feeder is obtained by moving it up and down with a connecting rod between the feeder and an adjustable disc. The feeder is driven through a chain and sprockets from the central drive.

The feeder type here illustrated and described is intended to be used with cableway delivery of material. When using the elevator type the material to be washed and screened is brought to the elevator by means of dump cars, drag scraper or otherwise, and passes through either a crusher or grizzly to the elevator. In case a grizzly is used, an apron feeder is necessary to feed the elevator.

Climax Appoints Maerky

Climax Engineering Company, Clinton, Iowa, announces the appointment of the Maerky Machine Works, 240 Cherry Street, Philadelphia, Pennsylvania, George M. Strohlein, proprietor and manager, as official parts and service station in the city of Philadelphia, Pennsylvania and vicinity.

The Maerky Machine Works has an enviable reputation of being expert machinists and we are quite confident that you will find this organization fully competent to take care of all service requirements. Their mechanics are experienced in gas engine work and are prepared to render immediate service.

New Incorporations

The Gibsonburg Lime Products Company, Gibsonburg, Ohio. Capital $300,000. Incorporators: C. H. Zarn, C. C. Zarn, A. M. Zarn, F. H. Rutschow and F. W. Zarn.

Mount Pleasant Silica Sand Company, Cape May City, N. J. (Deal in sand, etc.) Capital $40,000. William S. Vanzant, Harry P. Entriken, Frank Entriken, Sr., and others. Attorney, Samuel F. Eldridge, Cape May City.

Gypsum Products Sales Corporation. (Deal in gypsum and gypsum products.) Capital $10,000. Incorporators: L. Reed Fuller, Bernhard Knollenberg, New York City; Austin T. Foster, Westfield, N. J. (Corporation Trust Co. of America.)

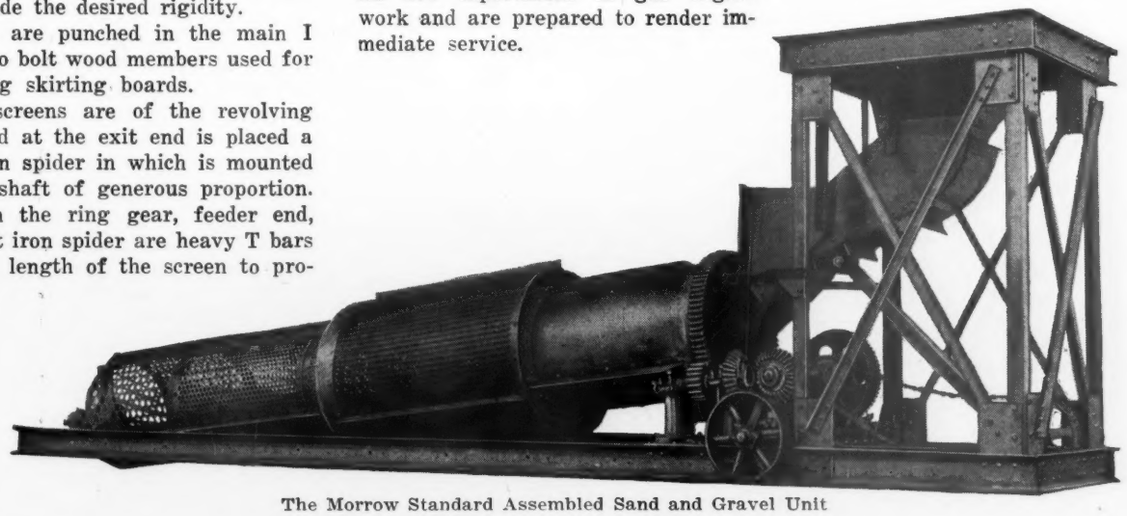
Heltonville Limestone Company, Bedford, Indiana. Capital $75,000. (Own and operate a stone mill, cut and manufacture stone for building purposes; to ship and market stone.) Incorporators: Chris D. Donato, Mary Donato, A. Russell Wallis.

Hoosier Moulding Sand Company, Martinsville, Indiana. (Producing and selling moulding sands, clays and other products.) Capital $25,000. Incorporators: Banas E. Neal, Silas C. Kivett and Bernice Guthridge.

National Building Units Corporation. (Manufacture cinder concrete building blocks.) Capital $37,500,000. Incorporators: Harold C. McCollom, Greenwich, Conn.; Jane M. G. Foster, Brooklyn, N. Y.; Wm. Redfield Porter, Englewood, N. J. (Corporation Trust Co., of America.)

Manhattan Lime Co., Manhattan, N. Y. Capital $50,000. Incorporators: W. M. Young and H. W. Swan. (Filed by F. P. Ufford, 111 Broadway, Manhattan.)

Polychrome Concrete Co., Inc., Blackwood, N. J. (Manufacturing concrete products.) Capital $150,000.



The Morrow Standard Assembled Sand and Gravel Unit

The Milburn Paint Spray

Paint spraying is the modern economical method of applying paint, varnish, etc. to all surfaces. In painting any character of devices or surfaces, time, material and labor costs are greatly reduced with the utilization of the proper gun or spray.

The ease and simplicity of operation of the Milburn paint spray is an outstanding feature. The paint enters a large, annular chamber surrounding the air nozzle from which it is atomized and expanded in a venturi-shape. The atomization is complete and is regulated by a mere turn of the nozzle, from a small to a large spray, or is entirely shut off, bringing into play a stream of air for dusting purposes increasing the speed of the work. A pressure of 40 pounds is excellent, but this can be varied to suit the work. Carbonic gas tanks are also employed with good results.

The thorough, minute atomization of paint results in a complete even coverage of a greater surface with minimum paint consumption. One coat is adequate with the Milburn atomization principle, where two coats are usually required by hair brushing. Air pockets and daubing are eliminated; places impossible to reach by brush, can be painted with the Milburn spray.

This paint spray is light in weight, compact and extremely efficient, employing a new and greatly simplified principle of construction, which accounts for its absence of moving parts and passages likely to clog. It consists of rugged cover, body, atomizer, and convenient handle. No small pats to get out of order or adjust.

Improvements in Vulcan Gasoline Locomotives

Announcement has just been made by the Vulcan Iron Works, Locomotive Builders of Wilkes-Barre, Pa., that they are now prepared to furnish their gasoline locomotives in all sizes from 8-tons up equipped with elliptic springs and cross-equalizers, giving three-point suspension of the chassis. With this design, derailment is a rare occurrence, inasmuch as the weight of the locomotive is always equalized on all the bearings regardless of any unevenness or irregularities in the track.

Three-point suspension is standard practice on all steam locomotives. Vulcan electric locomotives are of this design, and the heavy Vulcan gasoline locomotives (from 16-ton up) have always been so constructed. In fact, Vulcan is among the first in the field with this type of gasoline locomotive.

Among those who have already purchased Vulcan gasoline locomotives with 3-point suspension are The Mathieson Alkali Works, Canada Cement Company, Albany Crushed Stone Corp., Bethlehem Steel Co., National Tube Co., International Motor Co., Gary Tube Co., Utah Iron Ore Corp., St. Lawrence Paper Mills, E. B. Eddy Co., Stone & Webster, Inc., The Arundel Corporation, Bates & Rogers Construction Co.

Westinghouse Hold Annual Stockholders' Meeting

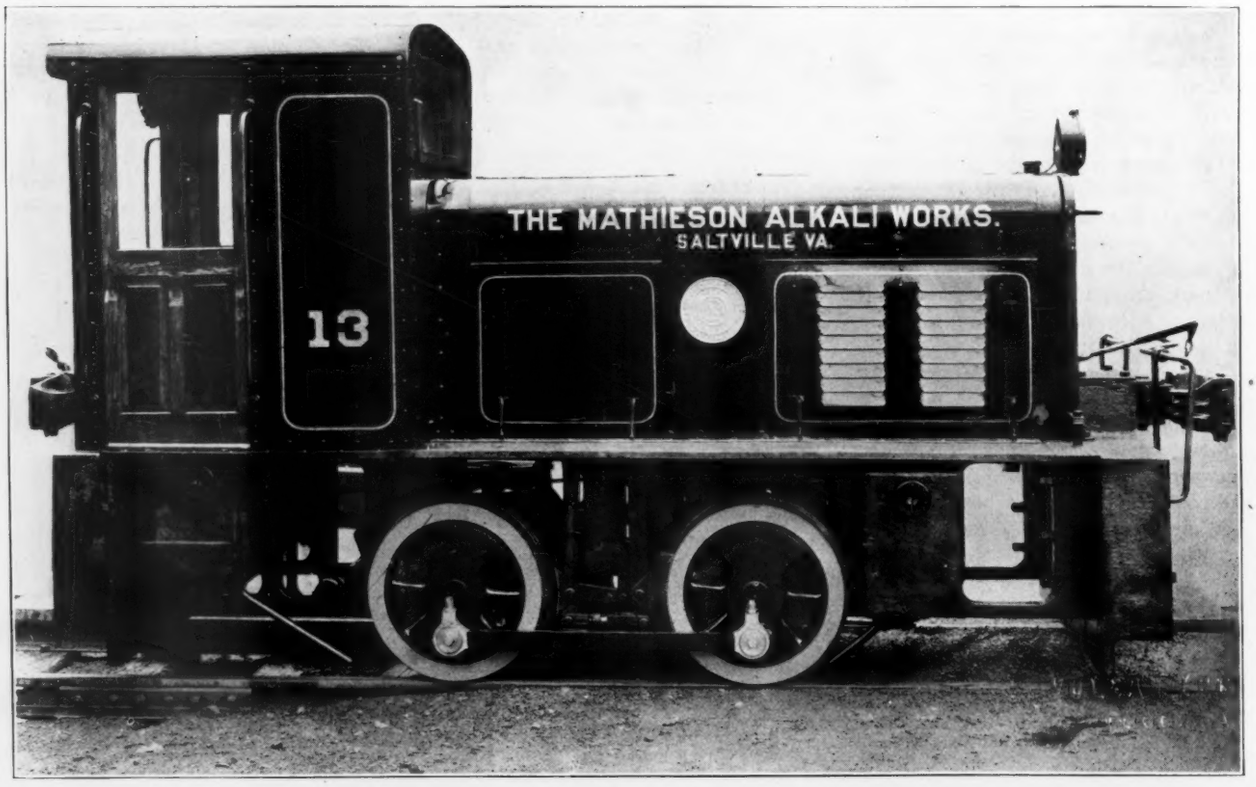
At the annual meeting of stockholders held recently in the main works of the Westinghouse Electric and Manufacturing Company, President E. M. Herr stated that business would probably maintain a satisfactory level during the ensuing year.

At the meeting the following directors whose terms expired today were reelected: F. A. Merrick, vice-president and general manager, Westinghouse Electric and Manufacturing Company; R. B. Mellon, president, the Mellon National Bank, Pittsburgh, Pa.; Geo. M. Verity, president, the American Rolling Mill Company, Middletown, Ohio; and Jerome J. Hanauer, of Kuhn, Loeb & Co., New York, N. Y.

Brisbin New President

At the recent convention of the American Supply and Machinery Manufacturers Association, one of the largest associations of its kind in the United States, Mr. Don S. Brisbin was elected president for the ensuing year.

Mr. Brisbin is manager of sales for the Columbus McKinnon Chain Company. He is a director of the Automobile Equipment Association and is widely and favorably known to the automotive and hardware fields through his constructive work in both industries and his authoritative addresses before various national conventions and assemblies.



Eight Ton Vulcan Gasoline Locomotive with Three Point Suspension

Interesting Interlocking System

An interlocked conveyor system used by the Lincoln Coal Company at Napfor, Kentucky, conveys coal from a new mine to the tipple, operating automatically and paying for its own maintenance by means of regeneration of electricity.

The tramway is of the automatic continuous carrier type and was built by the Interstate Equipment Corporation. It operates over a distance of 1,800 feet with a drop of 360 feet from the loading to the unloading end and has a capacity of 150 tons per hour. The system is started by a 40-horsepower motor which, after the speed builds up, acts as a generator and feeds power back into the line. The motor also, by this regenerative process, acts as a brake, thus preventing the conveyor from running away. The power fed back into the line is used by other motors on the system. such as the screen motor. A solenoid brake is provided for the purpose of stopping the conveyor in the event that a failure of power were to make the motor inoperative for braking.

Two mines are operated by the Lincoln Company at this point, both on the same side of a river, while the tipple is on the other side of the river. Coal is transported from the old mine to the tipple in cars drawn by electric locomotives, while the supply from the new mine is delivered at the tipple by means of the automatic conveyor system. Both supplies of coal are delivered to the same screen and after screening are loaded on cars on three different railroad tracks.

Coal is taken from the new mine in 1½-ton cars which discharge into a Jeffery weigh basket at the head of the tramway. From the weigh basket a Jeffery reciprocating feeder deposits the coal on a Jeffery apron conveyor used as a picking table which, in turn, deposits the coal in an undercut gate emptying into the main tramway loader. The tramway cars, each with a capacity of 1,000 pounds of coal, pass through the receiving terminal of the conveyor system at 10½-second intervals. The conveyor proper consists of two stationary tension cables used as tracks on which the tramway cars ride by means of four grooved wheels, and a single moving cable to which the cars are fixed, and which keeps the cars in motion. The motor which furnished the power for starting the system through the moving cable is located at the receiving end of the system. Another motor drives the picking table and feeder, and both motors are controlled by push buttons at the tipple, 1,800 feet away. General Electric motors and control are used.

The movement of the undercut gate at the receiving end of the system is controlled by a single-acting air hoist, the operation at this point being an important part of the system. The conveyor which acts as a picking table feeds just enough coal into the hopper to equal the rate at which the coal is taken away in cars on the cable way. In order to avoid any dribbling of coal between cars, the undercut gate is operated at definite points in a predetermined cycle. As the returning empty cars pass under the hopper, an air valve is operated, causing the gate to close at the bottom of the picking table and stopping the flow of coal into the tramway loader. At a point a short distance farther the empty car trips the hopper gate and the car is filled with coal. Having emptied the hopper, the car moves on and strikes another valve, releasing the air and causing the gate at the discharge end of the picking table to reopen and refill the hopper. By locating this last valve sufficiently far from the hopper, enough time elapses before the picking table gate reopens to allow the hopper discharge gate to close.

Galion Mono-Veyor

A new bulletin issued by the Galion Iron Works and Manufacturing Company, is of interest to anyone connected with the development of handling equipment and its many applications.

The Galion way of handling material is either by the skip hoist or the Mono-Veyor. The latter method gives rapid action at a moderate cost and can be adapted to a variety of yard layouts with a considerable distance from the switch. The Mono-Veyor lays coal or other breakable material on the pile without breakage.

The booklet shows by means of a line drawing how the Mono-Veyor operates over cylindrical pockets handling coal, coke, sand, gravel or other loose material.

An advantage claimed by the Mono-Veyor is that it can be operated with a fairly sharp turn in the mono-rail to accommodate loading points which may be placed on a curve or an irregular shape. Illustrations of some of the details used in the system such as the bucket, hoist and speed reduction unit, as well as typical installations assist in making the bulletin useful to those interested in this produc.

Dean Opens Philadelphia Office

The Dean Hill Pump Company have opened an office at 816 Real Estate Trust Company, Philadelphia, Penn.

Economy of Diesel Engine Power

Diesel engines offer such an unusual opportunity to reduce power costs in almost every industry that a new thirty-two page bulletin, "Economy of Diesel Engine Power," issued by Fairbanks, Morse & Company of Chicago, is of timely interest. The bulletin takes up an analysis of the various factors which affect the cost of power, such as fuel cost, operating labor, maintenance, first cost and fixed charges, reliability and simplicity. The costs of a typical small Diesel power plant are analyzed and compared with similar costs for a steam plant.

Other interesting chapters cover such points as the cost of purchased power, layout of the Diesel plant and the question of the fuel oil supply. Interwoven through this semi-technical story is a discussion of the application of Diesels in a wide variety of industries, together with illustrations of Diesel equipped plants. This book should be in the library of everyone who is interested in power, whether that interest be in connection with a small power problem or whether it be for a large power plant.

Climax Engines Listed By Underwriters

Announcement is made by the Climax Engineering Company, Clinton, Iowa, that the Underwriters' Laboratories, Inc., Chicago, have listed Climax Engines as approved for fire protection purposes. These are claimed to be the first medium-speed, industrial engines to gain the approval of the Underwriters' Laboratories for driving 750 and 1,000 gallon pumps.

The Climax Engines passed by the Underwriters are Models "R4U" and "R6U" with approved equipment. Basically it is the same engine that is being used largely in the industrial world for cranes, shovels, locomotives, pumping and generator sets.

A bulletin covering the Underwriters' model engine is now being prepared and will soon be distributed. Copies will be sent on request to any who are interested in securing detailed information.

Change In Name

The Universal Gypsum Company is now to be known as the Universal Gypsum and Lime Company, Chicago, Illinois. The Lancaster Sand and Gravel Co., Buffalo, N. Y., is now to be known as the East Aurora Sand and Gravel Company.

The Mayne Loader

The Webster Manufacturing Company have issued a catalog, number 45, describing the Mayne Loader. This device is the invention of a practical miner, who saw the need of a simple and efficient loading machine, which would solve the problem of underground loading.

The machine is designed for loading broken ore and rock in mine tunnels, eliminating the hard manual labor encountered in hand shoveling and reduces the number of men necessary to do this work. The machine can be used successfully for loading limestone, gypsum, zinc and lead ore or the like. It is a shoveling machine which is operated by compressed air, is simple and can be easily operated by any miner.

It is built in a strong and sturdy manner, is compact and is not too heavy or cumbersome to move as the total weight does not exceed 2200 pounds. The machine is moved ahead or backward by its own power, except when necessary to move some distance, when it is placed on a truck, which is part of the equipment supplied with the loader.

In design, the loader proper, sets on a steel plate which rests on the mine tracks and on this plate is a ball bearing race on which the loader platform can revolve in a full circle or 360 degrees.

The heavy steel platform has mounted on it angle iron tracks between and on each side of which are fastened four operating cylinders, two 6-inch crowding and two 5-inch hoisting cylinders. These cylinders are fed by a 1-inch pipe line and provided with controlling valves and pressure gauge.

One valve admits air to the crowding cylinders while the other admits air to the hoisting cylinders. The two outer or crowding clyinder pistons are pivotally connected to the dipper arms.

The hoisting pistons are fitted at the end with a cross head and wire rope sheave, two sheaves are attached to the loader frame, one at the top and the other at the bottom. A wire rope passes through these sheaves, one end being attached to the platform and the other end to the dipper. The booklet shows by means of half tones how the loader is used in mines and the descriptive matter assists in following its manipulations.

A line engraving of the machine is included on the last page of the catalog and a table giving the capacity, air consumption, weight, dimensions of the dipper, cylinders and track gauge enables those interested to know what space is necessary in the mine as well as air pressure recommended to operate the loader.

The P & B Oil Burner

A new oil burner, is now being manufactured and sold by F. Beers and Company. Careful tests have demonstrated that it uses only 1.3 per cent of steam.

It is exceedingly simple, has only three parts and is adaptable to any kind of flame to suit any type of furnace. It protects itself from overheating by absorbing the heat radiating through the cap into the steam used for atomizing.

For efficient burning it is well known by oil combustion experts that complete atomization of oil is necessary. The design of this burner is such that it causes the steam to break up the oil into very minute particles. The breaking up is done inside, not outside of the burner.

Four inside steam jets are employed, all acting at right angles with four oil jets. Steam consumption is thereby reduced to a low figure. Its small size gives it a number of important advantages: it does not project far into the furnace, hence there is no danger of overheating, carbonizing, and clogging; and every inch saved in length of burner virtually adds an equal number of inches to the length of the furnace.

There are no parts to adjust and get out of order. The correct size of oil and steam ports is determined by the pressures available and the capacity required. The burners can be altered for both larger and smaller capacity by changing the oil and steam ports along with the tip openings.

Traylor Engineers Sail

Richard Bernhard chief engineer, and Robert Reinhard assistant engineer, Traylor Engineering and Manufacturing Company, sailed on the Grace liner, Santa Elisa for Chile, on June 24th. They are going to El Melon, near Calara, about 40 miles from Valparaiso, Chile where the Sociedad Fabrica de Cemento de "El Melon" is going to erect a cement plant. Messrs. Bernhard and Reinhard are going to make the designs for the plant and the Traylor Engineering and Manufacturing Company and the International General Electric Company are to furnish the equipment for the complete installation. The International Machinery Company of Santiago, Chile was successful in obtaining the order for the erection and equipment of the plant in the face of the most severe British and other foreign competition. When completed, the plant will be able to turn out 1200 barrels of cement per day. Mr. Bernhard will later visit Peru, Argentina, and Brazil returning to the United States at the end of about three months.

Hayward Buckets

The Hayward Company have recently issued Bulletin 627. This illustrates by means of half tones a few of the many applications These buckets have been used for various purposes such as digging or handling bulk materials of practically every nature.

They are used to advantage when operated with a truck crane being easily attached or detached to the operating hoist.

Pages 8 and 9 of the booklet illustrate a few of the many types of the Hayward buckets such as orange peel, drag scraper, and clam shell. Complete information on other types than standard may be obtained on application.

Another section of the bulletin shows by means of several illustrations how the buckets are operated in connection with derricks or on cableways.

Some special applications of the Hayward buckets are shown and are of interest, one in particular being a pit extending to a depth of 100 feet, with straight sides in which one of the Orange Peel type of bucket was used successfully. Special hoisting equipment was not required, an ordinary bull wheel derrick being used to convey the bucket up and down the sides of the pit.

Gillispie Now With Jeffrey

The Jeffrey Manufacturing Company announces the election of Robert W. Gillispie as vice president, assistant general manager, and member of the board of directors.

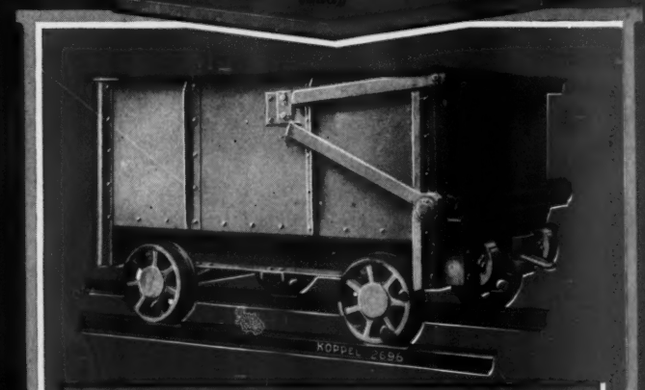
Mr. Gillispie has for many years been identified with the Bethlehem Steel Company, being connected with the executive sales work of that company. He was graduated from Wesleyan University, Connecticut, in the Class of 1904.

Multi-Stage Centrifugal Pumps

Bulletin Number 602 recently issued by the Dean Hill Pump Company, describes in an interesting manner the pumps of this type made by this company. A longitudinal section of a pump is of special interest in that it shows how the various elements fit together to form a complete pump.

KOPPEL CARS

Write for our new Quarry Bulletin today



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